PERSEUS
POLICY-ORIENTED MARINE ENVIRONMENTAL RESEARCH IN THE SOUTHERN EUROPEAN SEAS

Report on operation and data analysis from R/V monitoring for MSFD

Deliverable Nr. 3.7

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EXECUTIVE SUMMARY / ABSTRACT

This deliverable summarizes the research vessel observations that have been undertaken during the project lifetime. It provides a detailed description of what have been planned and actually executed by the partners within Subtask 3.2.3. in terms of oceanographic cruises during 2012-2015 in the Southern European Seas. A preliminary data analysis of collected CTD profiles is given for each subregion.

SCOPE

The overall scientific objectives of PERSEUS are to identify the interacting patterns of natural and human-driven pressures on the Mediterranean and Black Seas, to assess their impact on marine ecosystems and, using the objectives and principles of the Marine Strategy Framework Directive (MSFD) as a vehicle, to design an effective and innovative research governance framework based on sound scientific knowledge. The objectives of WP3 are to upgrade and expand the present observing capacity in the SES towards fulfillment of the scientific and society needs addressed by PERSEUS with emphasis on the characterization of present state, and to increase forecasting capabilities and provision of solid grounds for the implementation of MSFD.

1. INTRODUCTION

The Task 3.2 “Upgrade of existing observing components” considers the existing permanent routine observing systems and the scientific and society needs as well as the identified gaps, in order to carry out specific upgrades of the observing components, which will represent a valuable asset for the monitoring capacity of the SES in the future. PERSEUS has concentrated on upgrading and expanding new sensors for existing multi-parametric platforms such as moorings and ARGO profilers, as well as on R/V repeated monitoring by increasing the spatial and temporal resolution in key areas for the needs of MSFD. Collected data will become available through the PERSEUS Database (WP9). The Subtask 3.2.3 entitled “R/V repeated monitoring; increase spatio-temporal resolution and support upgrade/ expand existing surveys” had the scope of filling in the gaps left by oceanographic cruise, identified in the first task of WP3, by organizing the observational work which was necessary to complement the existing systems.

CTD data collected in some specific sections has been submitted to the project database and oceanographic sections, across sub-basin and through straits, on an annual basis and monthly visits to sites has ensured the collection of data for a number of variables that will help WP1, WP2 and WP4 to make the assessment of the GES as well as in-lab calibration of the sensors.

Since the subtask is meant to provide a means to fill in existing gaps, in the following a brief summary of the findings of Subtask 3.1.2. is given. In the deliverable D3.1 we reported the research ship monitoring programmes over the years 2009-2011, i.e. before the start of PERSEUS. The aim of sub-task 3.1.2 was to review observational network based on research ship surveys over the last years all sub-basins of the Mediterranean and Black Sea. Gaps were identified and recommendations were given to improve the network as a whole and to meet the PERSEUS objectives. Particular attention was given to all the physical (T, S, currents) and biogeochemical (oxygen, chlorophyll, nutrients, alkalinity, etc.) parameters measured.

The Mediterranean and Black Seas have been sampled quite extensively by different countries during the past years. The overall picture allowed us to identify gaps. The single years are quite similar, denoting the tendency of performing repeated cruises of most of the partners.

The maps shown in Fig. 1 were carefully analyzed and gaps are identified and recommendations are given to improve the network as a whole and to meet the PERSEUS objectives. The following map, showing all stations surveyed by the above mentioned institutes between 2009 and 2011 (i.e. before the start of Perseus), highlights the presence of “blank areas” (denoted by the circles), and the importance for SES community to increase the horizontal extension of their surveys in certain areas.

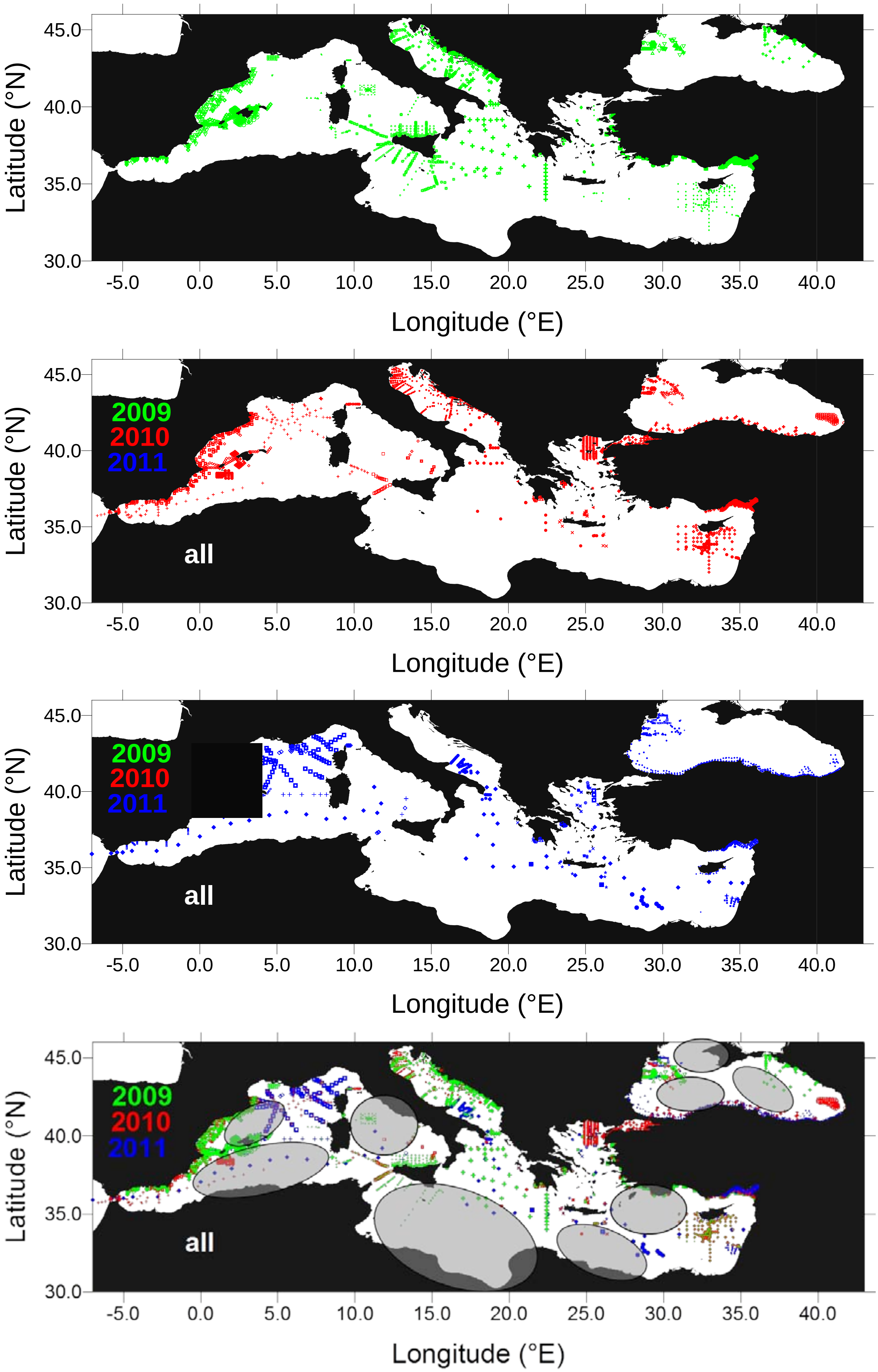


Figure 1. Station maps for single years (2009-2011) and combined station map 2009-2011 of all Institutes highlighting gaps in the data coverage.

2. Planned and executed cruises during 2012-2015

The aim of the S3.2.3 is to fill in the gaps of R/V repeated monitoring. The DoW identifies a number of key repeated sections and surveys. In order to establish a programming of the observational R/V based activity, partners were asked to fill in a questionnaire (detailed questionnaires can be found in the Appendix) about their R/V survey plans for the duration of the project. In the following we report the R/V cruises proposed in the DoW along with the actual plans of the involved partners, highlighting critical points.

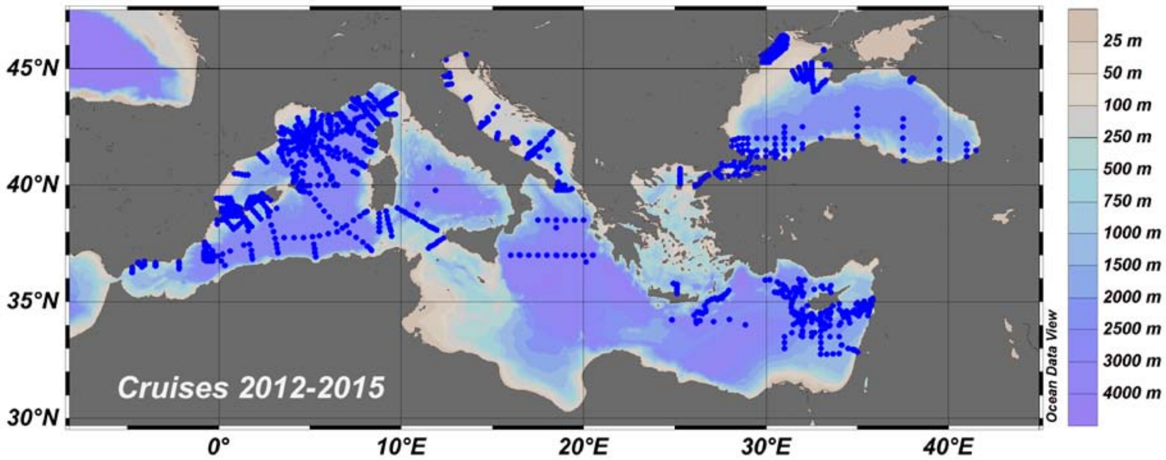


Figure 3. Combined Station map 2012-2015.

In the map in Figure 3 the stations of all cruises carried out by the partners in the period 2012-2015 are shown. Comparing Fig. 3 with Fig. 2 it appears that the gaps have been filled only partially. Substantial improvement is to be highlighted for the Algerian Basin, the north-western Mediterranean, the north-eastern Mediterranean as well as for the Black Sea. The southern Ionian Sea is still under-sampled (not sampled at all during Perseus), but this has to be mainly ascribed to political issues and ongoing conflicts in the southern shore countries. In general terms, the planning done in the DoW has been widely respected by the partners, even if a higher degree of adaptability of the cruise planning, after the outcomes of Task 3.1., would have been a wiser choice. More details on the single cruises are provided in the next paragraphs.

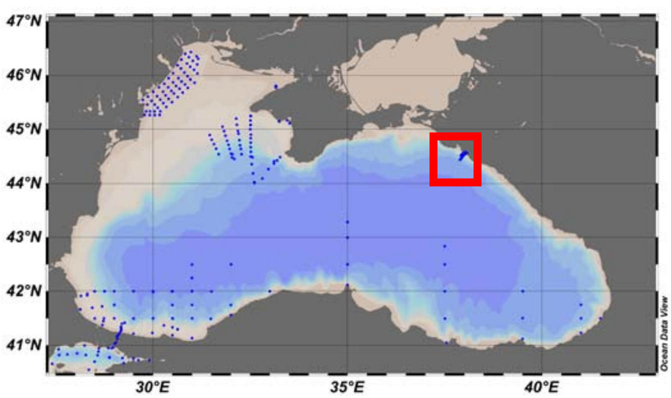
1) **REPEATED CROSS SECTION IN THE NORTH-EASTERN BLACK SEA (PARTICIPANT: SIORAS)**

   According to the DOW "Activities, on a *monthly* time scale, will be concentrated on a transect offshore Gelendzhik, using a small R/V from the coast to the outer part of the continental slope at 1.500 m depth, 8-11 miles offshore: 7-9 CTD casts including biogeochemical data, including nutrients (PO4, Si, NO2, NO3, NH4), Chl-a, *dissolved oxygen and hydrogen sulphide*, pH, and alkalinity as well as spatial distribution of phytoplankton, mesozooplankton, and gelatinous macrozooplankton (including non-indigenous ctenophores), changes in species composition, abundance and biomass, will be carried out as well as profiles using the new Aqualog ocean profiler designed for offshore environmental monitoring, from 10-1000 m depth. These parameters can be used as qualitative descriptors for determination of environmental status (MSFD). This will upgrade the long-term monitoring (zooplankton, phytoplankton and hydro physical parameters) that was initiated in 2005."

According to the questionnaire (see Appendix): SIORAS planned 6 one-day cruises per year (*bi-monthly*) starting in March 2013 and ending in October 2015 with the objective of contributing in the creation of time series of hydrophysical, hydrochemical and biological parameter measurements along the transect across the coastal zone off Gelendzhik (NE Black Sea), to study major circulation features of coastal dynamics and its influence on the ecosystem. These cruises are designated also as part of another (national) project ("Fundamental problems of ocean: physics, geology, biology, ecology". Coordinating body: Presidium of Russian Academy of Sciences). Parameters: CTD, nutrients (PO4, Si, NO2, NO3, NH4), pH, alkalinity, pelagic bacteria/micro-organisms, phytoplankton pigment and species composition, zooplankton abundance and species composition, *POC, PON*.

Cruises actually carried out: SIORAS carried out 6 cruises in 2013 and 6 cruises in 2014. The cruise list and station map is shown below. No activity is planned for 2015.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI
Apr13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
May13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Jun13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Jul13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Sep13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Nov13	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Apr14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
May14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Jun14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Jul14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Sep14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.
Oct14	44.49	44.58	37.95	38.07	Ashamba	Arashkevich E.



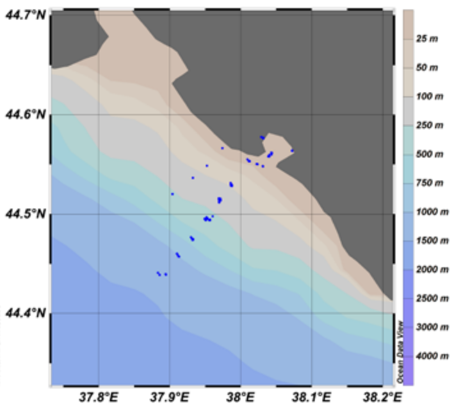


Figure 4. SIORAS cruises: (left) Black Sea station map where SIORAS working area is highlighted; (right) SIORAS repeated transect.

2) REPEATED CRUISES IN THE NORTH-WESTERN BLACK SEA (PARTICIPANT: MHI)

According to the DOW "Activities will focus on the NW Black Sea shelf, Danube paleo-canyon, in transects Cape "Chersonese- Bosporus", "Cape Chersonese-Danube", and South Crimea shelf: CTD casts, current velocity profiles, bio- optical (by FRR fluorimeter), biogeochemical data, including nutrients (PO4, Si, NO2, NO3, NH4), Chl-a, dissolved oxygen and hydrogen sulphide, pH, alkalinity, and spatial distribution of phytoplankton. The pilot observations in transects “Sevastopol-Istanbul’ will be provided by the ferry boats.”

According to the questionnaire (see Appendix): MHI planned to carry out 2 long cruises on board of R/V “Professor Vodyanitsky” and 3 cruises on small-size ship, between August and November 2013, with the main objective to contribute in measurements of optical, physical and biochemical parameters in the Western part of the Black Sea: monitoring the repeat transect “Chersones - Bosporus”; observations of transformation of Cold Intermediate Layer; study of seasonal evolution of Sevastopol anticyclonic eddy; hydrological observations in coastal zone near Dnestr and Danube estuaries and near Zmeinuy island with the aim to study of river water transformation in summer period; vertical profiling of currents by ADCP. Parameters. CTD, L-ADCP, oxygen, phosphate, nitrate. The location of the casts at the Black Sea was chosen, since permit to study of seasonal evolution of Sevastopol anticyclonic eddy and of river water transformation on the shelf and its impact on the shelf ecosystem.

Cruises actually carried out: Only one cruise in September 2013 was carried out. MHI is no longer a PERSEUS partner. The data collected have been correctly transmitted to the Perseus database. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI
Sep13	44	46.5	29.5	33.6	R/V “Professor Vodyanitsky”	-

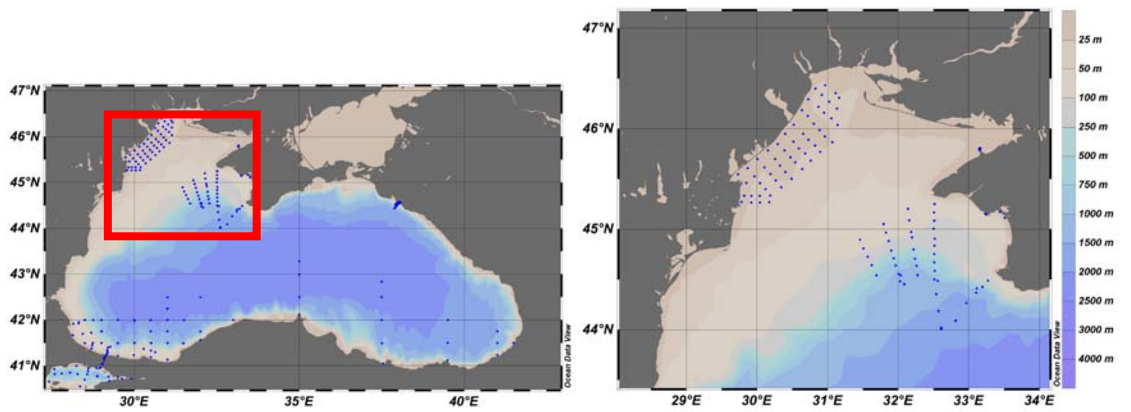


Figure 5. MHI cruise: (left) Black Sea station map where MHI working area is highlighted; (right) MHI station map.

3) REPEATED CRUISES OR SECTIONS IN THE EASTERN MEDITERRANEAN SEA: A) SOUTH AEGEAN (PARTICIPANT: HCMR)

According to the DOW “In the South Aegean Sea (Cretan Sea) monthly cruises will be conducted by the HCMR to visit the E1- M3A mooring location. The biochemistry of this area has been studied approximately every 2 years since 1987. Since 2007, CTD casts of the entire water column at the E1-M3A location are done seasonally to annually through the POSEIDON project. From the beginning of 2010, additional monthly visits are made to measure optical and physical (T, S) properties down to 150m depth and biochemical parameters (DO, chl-a, PO4, Si, NO2, NO3, NH4) down to 100m depth. An upgrade will be carried out to provide these parameters at NRT (<3 days) and to include bacteria and zooplankton biomass in delayed mode (6 months) as well as to make deeper CTD casts every month."

According to the questionnaire (see Appendix): HCMR planned one-day monthly cruises starting in January 2013 and ending in June 2015 with the objective of contributing to the creation of a times series of optical, physical and biochemical parameters measurements using a Research vessel at the location of the POSEIDON-E1-M3A buoy. Parameters: CTD, nutrients (PO4, Si, NO2, NO3, NH4), DO, pelagic bacteria/micro-organisms, phytoplankton pigment, zooplankton abundance and size.

Cruises actually carried out: the HCMR R/V activities started in April 2013 (sampling was not possible from January to March), CTD casts and samples for all parameters declared in the DOW were taken except for O2. HCMR visited the E1-M3A location 5 times in 2013, 11 times in 2014 and 3 times in 2015. In addition HCMR carried out to longer cruises in 2013: PERSEUS0513 (May 2013) and PERSEUS1013 (October 2013), occupying respectively a north-south transect in the Southern Aegean Sea and in the Northern Aegean Sea. The cruise list and station map is shown below.

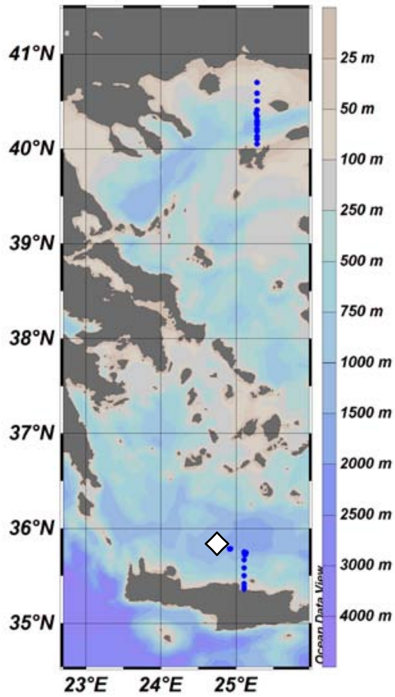


Figure 6. HCMR cruises (white diamond is the location of the fixed site E1-M3A).

HCMR one-day monthly cruises at E1-M3A (white diamond in the map):

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI
Apr13	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
May13	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Oct13	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Nov13	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.

Dec13	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Jan14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Feb14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Mar14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Apr14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
May14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Jun14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Jul14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Sep14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Oct14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Nov14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Dec14	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Mar15	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
Apr15	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.
May15	35.35	35.76	25.09	25.16	IOLKOS/FILIA/AEGEAO	Frangoulis C.

PERSEUS0513 and PERSEUS1013 cruises:

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
May13	35	36	25.09	25.09	-	PERSEUS0513
Oct13	40	41	25.2	25.2	-	PERSEUS1013

4) REPEATED CRUISES OR SECTIONS IN THE EASTERN MEDITERRANEAN SEA: B) SOUTH-EAST LEVANTINE (PARTICIPANT: IOLR)

According to the DOW "In the south-east Levantine basin, on a section off Haifa, *seasonal* observations will be carried out by the IOLR using R/V Shikmona. The section includes 6 CTD stations starting in Haifa Bay (the area under intensive anthropogenic pressure) and ending in open sea area of 1.600 m depth, 45 miles from the coast. High resolution (1m) profiles will be taken at each station measuring temperature, salinity, oxygen, fluorescence (chlorophyll), and beam attenuation. In addition, water will be sampled in water mass cores and particular points, and analysed for oxygen, nutrients (PO4, SiOH4, NO2, NO3, *NH4*), *Chl-a*. Regular observations on the Haifa section started in 2002. The H05 station (1400m), where the relative regular observations started in 1979, was appointed a WOCE type observation point in the Levantine basin by the SESAME project. Observations on the Haifa Section are essential for *calibration of gliders and ARGO floats*, as well as for long term monitoring of the Levantine surface water salinity, which defines the intensity of intermediate water formation in the Levantine and deep water formation in the Aegean."

According to the questionnaire (see Appendix): IOLR planned one-day *half-year* cruises starting in March 2013 and ending in September 2015 with the objective of investigating long term changes of the seawater physical and chemical parameters in the South Eastern Levantine, *and validation of a hydrodynamic model of shelf circulation*. These cruises are designated also as part of another (institutional) project ("Haifa Section". Coordinating body: IOLR). Parameters: CTD, oxygen, phosphate, *total – P*, nitrate, nitrite, *total – N*, silicate, *alkalinity, pH*.
Cruises actually carried out: IOLR carried out 2 cruises in 2013, 2 in 2014, and up tp now 1 in 2015 (cruises named from "Haifa Section 29" to "Haifa Section 33"). The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI
Mar13	32.8	33.2	34.1	34.93	Shikmona	Isaac Gertman
Dec13	32.8	33.2	34.1	34.93	Shikmona	Isaac Gertman
Aug14	32.8	33.2	34.1	34.93	Shikmona	Isaac Gertman
Nov14	32.8	33.2	34.1	34.93	Shikmona	Isaac Gertman
Mar15	32.8	33.2	34.1	34.93	Shikmona	Isaac Gertman

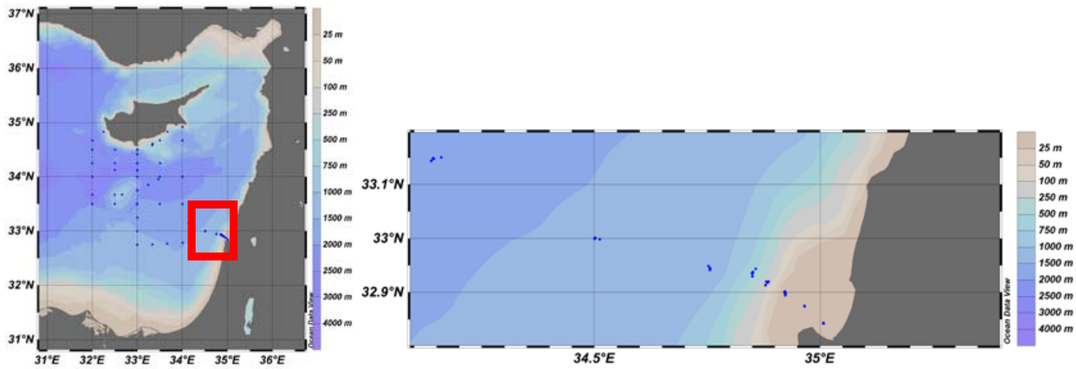


Figure 7. IOLR cruises: (left) Eastern Levantine station map where IOLR working area is highlighted; (right) IOLR repeated transect.

5) REPEATED CRUISES OR SECTIONS IN THE EASTERN MEDITERRANEAN SEA: C) CYPRUS (PARTICIPANT: OC-UCY)

According to the DOW "OC-UCY will carry out multidisciplinary (physical and biochemical) N-S monitoring along 33 °E, from Limassol, Cyprus down to the south, to 33°N, onboard multi-purposed vessels. Along this transect of 90 nm, the OC-UCY will carry out sampling at 11 stations, from surface down to a maximum depth of 1500 meters, annually. This transect has been well-monitored over the last 15 years by OC-UCY, during the CYBO cruises. This transect monitoring will be combined with the CYBO cruises in the broader SE Levantine Basin. Moreover, along the same transect, additional physical data will be collected onboard VOS, from Limassol to Port Said. This transect is well-monitored by the Cyprus VOS cruises in the framework of MFSTEP and MFSPP projects. Along this VOS transect of 180 nm length, the OC-UCY will carry out sampling at 18 stations down to a maximum depth of 700m, *3-4 times per year*, depending on the VOS availability. The VOS cruises strategy will be combined with the CPR field sampling."

According to the questionnaire (see Appendix): OC-UCY planned *bi-monthly* (one day) and annual (3-10 days) cruises starting in April 2012 and ending in December 2013 with the objective of obtaining a bi-monthly times series of physical and biological parameters measurements of a coastal domain with up to 10 stations in the Limassol Bay, Levantine Basin (the MEDZOO daily cruises); of collecting data for the evaluation of the benthic fish stock abundance in the waters of the Republic of Cyprus for the Period 2011-2013 (the annual MEDITS with 10 days duration); of collecting data along 33°E in order to monitor the transport of the AW, of the Cyprus eddy and of the MMJ (the annual CYBO with 3 days duration). These cruises are designated also as part of other projects: international "MEDZOO" (Coordinating body: CIESM), national "MEDITS 2011-2013" (Coordinating body: AP MARINE ENVIRONMENTAL CONSULTANCY LTD), national "CYBO" (Coordinating body: OC-UCY). Parameters: CTD, Zooplankton abundance and size.

Cruises actually carried out: Some of the MedZOO bi-monthly cruises in Limassol Bay (April 2012, June 2012), the MEDITS cruises in coastal zone in 2012 (June 2012–also CTD and zooplankton around Cyprus), the CYBO cruise along 33°E (2012 had 2 reduced versions, both of which had stations on the line, October 2012, December 2012), the Pelagia cruise (deep casts CTD in a small area, October 2012), the CYBO-OCB cruises (open sea CTD near a moored platform, and some stations along the 33°E line, September 2012, December 2012), the Basilikos cruise (CTD ADCP near the coast just east of Limassol, August 2012). CYBO cruises were reduced because of budget cuts (10/11 stations were done in October 2012, and only 5/11 in December 2012). MEDITS did take place in 2013, Zooplankton cruises missing after June 2012 and in 2013. Not all the data of the above mentioned cruises could be retrieved from the Perseus database and Seadatanet. In the map and in the cruise list only those cruise are present for which the data could have actually been located.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI
Oct12	33.5	35	32	34	Shikmona	G. Zodiatis/CYBO25a
Dec12	33.5	35	32	34	Shikmona	G. Zodiatis/CYBO25b
Feb13	33.67	33.67	31.42	31.42	Shikmona	D. Hayes/CYOCB4
May13	33	33.8	31	32	Shikmona	D. Hayes/CYOCB5
Dec13	32.75	34.5	33	35	Shikmona	G. Zodiatis/CYBO26

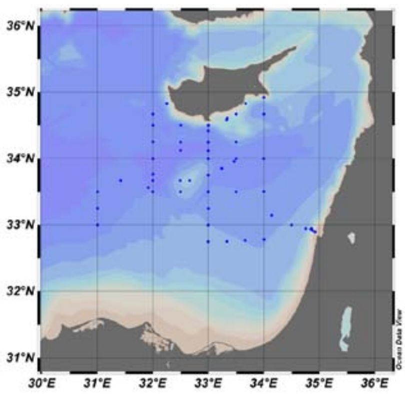


Figure 8. OC-UCY cruises.

6) REPEATED CRUISES OR SECTIONS IN THE EASTERN MEDITERRANEAN SEA: D) sections /cruises in the Turkish Straits System (Participant: METU)

According to the DOW "Mediterranean-Black Sea exchanges: monitoring at the Turkish Straits System (TSS), mainly focusing on the Bosporus Strait will make use of (1) existing nutrient and plankton samples and periodically collection of new nutrients (phosphate, silicate and nitrate), chlorophyll and plankton samples at predetermined intervals, (2) Analyzing air filters (over 2000 samples) already collected at coastal locations (Erdemli, Sinop, Gokceada, Istanbul) with some additional samples to be collected during the cruises for assessment of atmospheric deposition. "

According to the questionnaire (see Appendix): no questionnaire received, but three cruise sheets received recently. For details see below.

Cruises actually carried out: METU carried out three main cruises, MAREX (June 2013), BSEX (July 2013) and BSEX2 (November 2014). The cruise list and station maps are shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Jun13	40	41.3	26.1	29.9	Bilim-2	S. Tugrul/MAREX
Jul13	41.1	43.3	28.1	41.5	Bilim-2	B. Salihoglu/BSEX
Nov14	40.8	42.2	28.1	31	Bilim-2	H. Örek/BSEX2

1. MAREX – Marmara Sea Experiment cruise (also WP1.3) in the Turkish Straits System: Stations are selected on coastal and offshore regions of the Marmara Sea and along the two straits to monitor two-layered flows in the straits. The main aim of this cruise was to understand pressures and impacts on the Marmara ecosystem and major processes dominating the two-layer ecosystem in the TSS. During the cruise, samples were collected for the physical, biological and chemical parameters at pre-defined stations. Samples, taken by rosette system and WP2 nets or sediment samplers (Grab) processed on board and preserved for the laboratory analysis in the institute. Parameters: CTD, PAR, Fluorescence, Oxygen, phytoplankton, cyanobacteria and heterotrophic bacteria, primary production, pigment, Zooplankton, jellyfish, Ichtyoplankton, NO3, NO2, PO4, NH4, TP, POM, POC, PON, Si, DIP, TIN, DOW, pH, Chl-a, TSS, BOD5, contaminants in sediment, Cesium sampling, Atmospheric deposition.

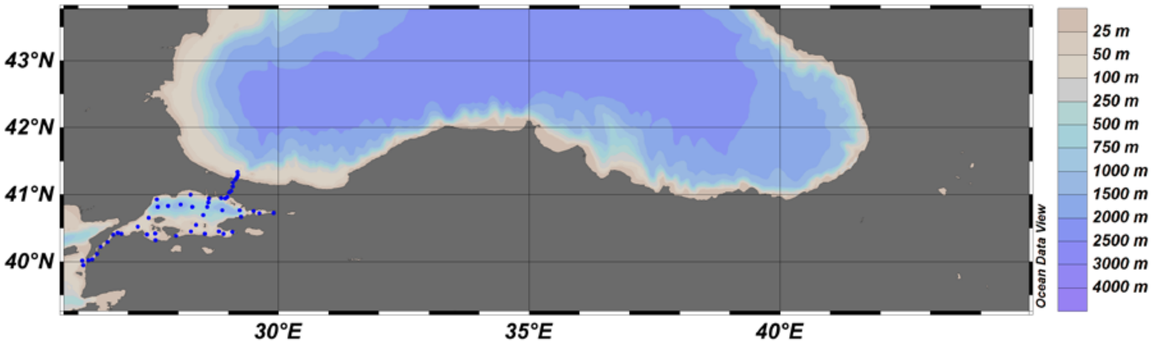


Figure 9. METU MAREX cruise.

2. BSEX – Black Sea Experiment cruise (also WP1.3) in the Southern part of the Black Sea: Cruise was carried out during the summer of 2013 to measure the level of nutrients and oxygen and the ratios (silica, nitrogen and phosphorus) and distribution of phytoplankton, zooplankton and impact of gelatinous zooplankton is observed. Parameters: CTD, O2, nutrients, pH, chl, PAR, TOC, TN, bacterial biomass/production, PP, Phytoplankton, Mesozooplankton, Gelatinous organisms, Eggs and larvae, Fish acoustics, Food web PP vs fish biomass, Atm deposition, Contaminants, contaminants in fish (heavy metal), Box corer/corer sample.

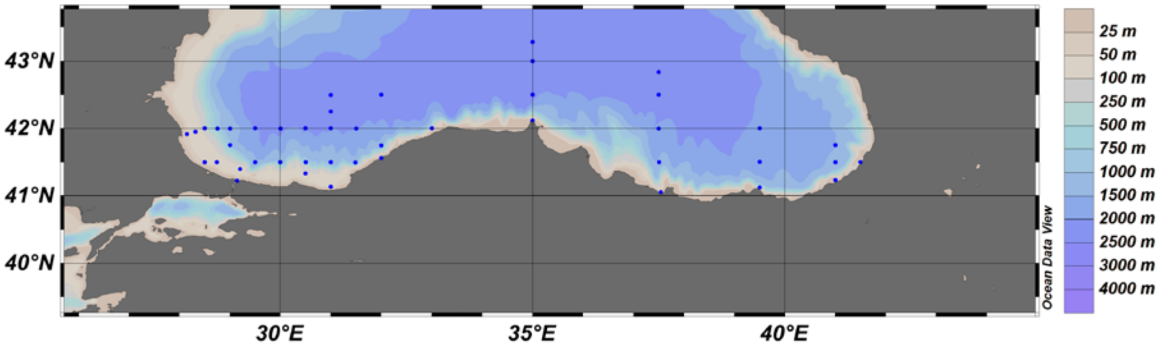


Figure 10. METU BSEX cruise.

3. BSEX2 – Black Sea Experiment cruise (also WP1.3) in the South-western ern part of the Black Sea:

Parameters: CTD, Nutrients, pH, DO, Surface TSM, zooplankton, phytoplankton.

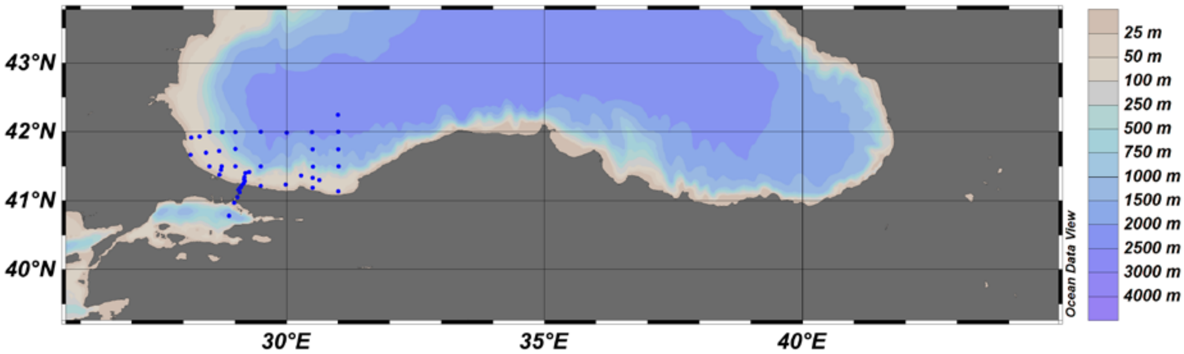


Figure 11. METU BSEX2 cruise.

7.1) REPEATED CRUISES OR SECTIONS IN THE WESTERN MEDITERRANEAN SEA: A) RADMED CROSS SECTIONS (PARTICIPANT: IEO)

According to the DOW "The RADMED cross sections, covering different sections in the Alboran Sea from the shelf to the deep sea (offshore slope) along the Spanish coast (reaching Barcelona and including the Balearic channels) have been historically carried out by the IEO (from 2007, but in some sections, since 1995): they will be continued and expanded including biogeochemical data to better establish the interactions between Atlantic and Mediterranean Waters and the North/South Exchanges in the western Mediterranean."

According to the questionnaire (see Appendix): IEO planned 20-days seasonal cruises starting in March 2012 and ending in June 2015 with the objective of a space-time monitoring of physical variables, chemical, biological meaningful and *distribution of phytoplankton and zooplankton communities* in profiles located at special points along the Spanish Mediterranean coast. For their achievement should be made an oceanographic sampling on a four month basis, covering transects perpendicular to the coast at special points in the Spanish Mediterranean. These cruises are designated also as part of another institutional project ("RADMED-DOS". Coordinating body: IEO). Parameters: CTD, phosphate, nitrate, nitrite, silicate, *phytoplankton pigments*, *zooplankton*.

Cruises actually carried out: In 2012 IEO had scheduled three 20-days seasonal cruises. The first RADMED-0312 cruise took place between days 24/03/12 to 13/04/12, the following two at June and October could not be carried out by technical problems with the ships. In 2013 IEO has carried out 5 cruises, 6 in 2014 and 2 in 2015 ("Canales Scheme" and "Radmed Scheme", see figures below). Parameters: CTD, nutrients (phosphate, silicate, nitrite and nitrate), phytoplankton pigments and zooplankton are measured during these cruises. In addition IEO participated to the ALBOREX experiment in May 2014. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Mar12	36.25	41.32	-2.2	4.6	Emma Bardán	J. Lopez-Jurado/RADMED0312
Mar13	36.25	41.32	-4.75	4.58	SOCIB	J. Lopez-Jurado/RADMED0313
Jun13	38.8	41.3	0.1	4.6	SOCIB	J. Lopez-Jurado/RADMED0613
Nov13	36.25	41.32	-4.75	4.58	F.P. NAVARRO	J. Lopez-Jurado/RADMED1113
Feb14	36.25	41.32	-4.75	4.58	F.P. NAVARRO	J. Lopez-Jurado/RADMED0214
Jun14	38.3	39.5	-0.1	2.4	SOCIB	J. Lopez-Jurado/RADMED0613
Nov14	36.25	41.32	-4.75	4.58	F.P. NAVARRO	J. Lopez-Jurado/RADMED1114

7.2) REPEATED CRUISES OR SECTIONS IN THE WESTERN MEDITERRANEAN SEA: A) CANALES SECTIONS (PARTICIPANT: SOCIB)

In addition to the RADMED section, SOCIB is also involved in subtask 3.2.3 with the repeated "Canales" monitoring program. The SOCIB Canales ship missions are undertaken in the Balearic Channels, namely the Ibiza and Mallorca Channels. These narrow and relatively shallow channels are important restriction points in the basin scale circulation of the Mediterranean Sea, particularly the Ibiza Channel (IC). The Ibiza Channel is an important 'choke' point, governing an inter-sub basin exchange of different water mass that is known to affect local ecosystems in a region of high biodiversity. The SOCIB 'Canales' ship missions aim to monitor transects across both the IC and MC 4 times a year (seasonally), approximately perpendicular to the main current flows. In order to monitor the inter sub-basin exchange of water mass and support the fast repeat glider endurance line missions (see PERSEUS Deliverable D3.6 for details), also undertaken by SOCIB in the IC as part of the multi-platform approach to ocean monitoring. The R/V SOCIB, a fast catamaran purpose built for regional oceanographic missions (see www.socib.es), is used for the SOCIB 'Canales' ship missions. Generally one transect of the MC is undertaken (10 stations) and 2 transects of the IC, one coincident with the glider endurance line transect at approx. 39 °N and the second 15 km to the south (10 and 8 stations respectively). At each station, CTD, oxygen, fluorescence, and turbidity are measured, and water samples for oxygen and salinity. High accuracy, vessel mounted ADCP monitoring is also undertaken (additional ADCP transects can be captured over night) as well as meteorological parameters and surface salinity and temperature from a thermosalinograph. The ship missions are coordinated with the SOCIB glider endurance line monitoring missions and provide additional information on the flows in the east of the IC, an important means of correcting the glider CTD against in-situ samples, and an important cross-check for the geostrophic velocity calculations that give a measure of water transport through the channels.

Cruises actually carried out: Commencing in 2013, SOCIB has now undertaken 5 SOCIB 'Canales' Ship missions, 1 in 2013, 3 in 2014 and 1 in 2015, with 2 more planned. The SOCIB 'Canales' ship transects help support the IEO RADMED cruise time series, as they are undertaken in similar locations. In addition SOCIB supported the PERSEUS WP3 Task 3.4 multi-platform Experiment, ALBOREX, which was undertaken in May 2014. The ALBOREX Experiment was a multi-platform, synoptic and intensive experiment, lead by IMEDEA (CSIC-UIB) for PERSEUS, with strong support from SOCIB, OGS, CNR, WHOI and McGill University. Sampling was undertaken at an intense front where Atlantic and Mediterranean waters meet in the Eastern Alboran Sea, to the south of the IC. The experiment took place over 8 days and included a range of oceanographic platforms, sampling concurrently in order to more effectively capture the intense but transient motion associated with mesoscale and sub-mesoscale features along the intense front, including submesoscale vertical motion. During the experiment 25 drifters, 2 gliders, 3 Argo floats were deployed, and the R/V SOCIB catamaran sampled 66 stations. The CTD data from all the SOCIB ship missions reported here are available in Coriolis.

Period	**Lat min**	**Lat max**	**Lon min**	**Lon max**	**R/V name**	**PI/Cruise name**
Dec13	38.8	39.5	0	2.4	SOCIB	J. Tintorè/ SOCIB_Canales_Dec2013
Feb14	38.8	39.5	0	2.4	SOCIB	J. Tintorè/ SOCIB_Canales_Feb2014
May14	36.5	37.5	-1.5	0	SOCIB	A.Pascual/PERSEUS_EPR_ALBOREX_May2014
May14	38.8	39.5	0	2.4	SOCIB	J. Tintorè/ SOCIB_Canales_May2014
Nov14	38.8	39.5	0	2.4	SOCIB	J. Tintorè/ SOCIB_Canales_Nov2014
Apr15	38.8	39.5	0	2.4	SOCIB	J. Tintorè/ SOCIB_Canales_Apr2015
May15	38.1	39.5	0.2	2.8	SOCIB	J. Tintorè/ SOCIB-SHEBEX-MAY2015

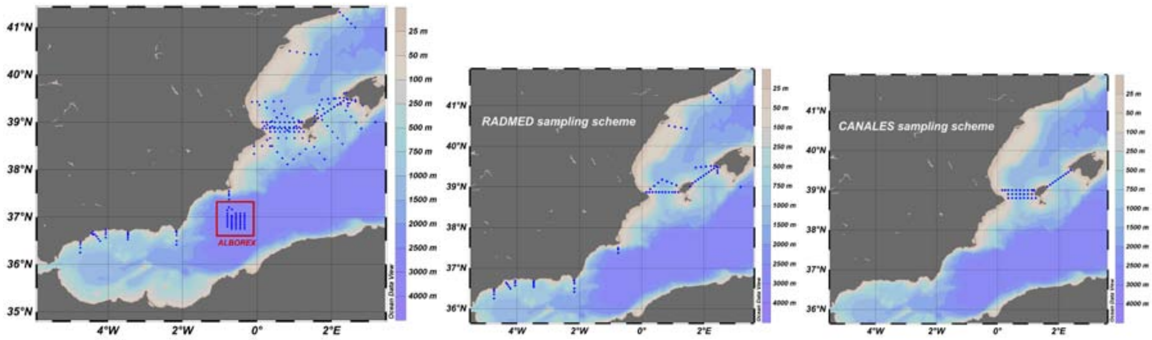


Figure 12. IEO+SOCIB cruise map (left), and typical RADMED (centre) and CANALES (right) sampling schemes.

8) REPEATED CRUISES OR SECTIONS IN THE WESTERN MEDITERRANEAN SEA: B) MOOSE MONTHLY CRUISES (PARTICIPANT: CNRS)

According to the DOW "The MOOSE monthly cruises along the French coast, off Banyuls, Marseille and Villefranche, again from the shelf to deep sea environment (<50km offshore). Full depth profiles. Automatic collection of T, S, O2, Fluorescence Chl-a, Turbidity. Water samples for oxygen, pigments, salinity, cytometry, nutrients and DIC."

According to the questionnaire (see Appendix): CNRS planned one-day monthly cruises starting in January 2012 and ending in December 2015 with the objective of observing the long-term evolution of the NW Mediterranean Sea in the context of the climate change and anthropogenic pressure (over > 10 yrs) in order to be able to detect and identify long-term environmental trend and anomalies of the marine ecosystem. Presently, MOOSE is combining eulerian observatories, autonomous mobile platforms (profilers, gliders) and research vessels. The eulerian observation is organized in three mooring sites in which a ship survey is performed on a monthly basis (DYFAMED), in the Ligurian Sea for atmospheric and marine flux transfer to the surface and deep waters (since 1988, OOV, Eurosites, MOOSE-DYF); ANTARES in the north western current offshore from Toulon for hydrodynamic and organic matter remineralization in deep water, MOOSE-ANT; MOLA in the western part of the Gulf of Lions off the marine station in Banyuls, devoted to the bacterial diversity in relation to the variability of the hydrology, MOOSE-MOL). Parameters: CTD, oxygen, fluorescence (chlorophyll), and beam attenuation, nutrients, alkalinity, dissolved inorganic carbon, pelagic bacteria/micro-organisms, phytoplankton pigment.

Cruises actually carried out: in 2012 CNRS carried out monthly cruises along a transect from the shelf, in front of Nice, to the deep sea environment, with the last station offshore being identified with the historical DYFAMED (approx. 43.4 °N, 7.9°E, white diamond in the station map) station. No monthly data of the whole transect between 2013 and 2015 have been located, while DYFAMED only has been repeated approximately on a monthly basis during the whole period. All data have been retrieved from Seadatanet. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
2012, monthly	43.3	43.7	7.3	7.9	Téthys	L.Coppola/Boussol +Dyfamed
2013, monthly (excl. Jan, Feb, Jun)	43.4	43.4	7.9	7.9	Téthys	L. Coppola/ Dyfamed
2014, monthly (excl. Jan, Feb, Jul, Oct)	43.4	43.4	7.9	7.9	Téthys	L. Coppola/ Dyfamed

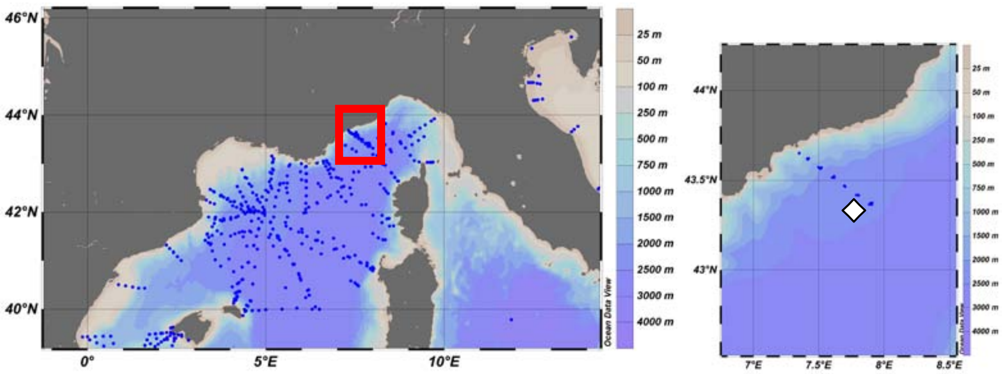


Figure 13. CNRS cruises: (left) North-western Mediterranean station map where MOOSE monthly cruises working area is highlighted; (right) CNRS montlhy repeated transect and DYFAMED station (white diamond).

9) REPEATED CRUISES OR SECTIONS IN THE WESTERN MEDITERRANEAN SEA: C) MEDOCC SERIES (PARTICIPANT: CNR)

<u>According to the DOW</u> “The MEDOCC series (carried out by the CNR, at the western basin scale), western basin-scale surveys through hydrographic multidisciplinary sections, closing sub-volumes of the basin, following a box-model approach to allow budget computations of mass, salt, heat and biogeochemical properties. The Ligurian section crosses the DYFAMED position. The Corsica and Sicily sections correspond to the CORSICA, C01 and C02 moorings, respectively. This survey has already been carried out in 2005, 2006, 2007 and 2008. During PERSEUS it will be effected one time and coordinated with the annual MOOSE cruise.”

<u>According to the questionnaire (see Appendix)</u>: CNR planned one 25 days long cruise for April-May 2014 with the objective of continuing the MEDOCC series, i.e. western basin-scale surveys through hydrographic multidisciplinary sections, closing sub-volumes of the basin, following a box-model approach to allow budget computations of mass, salt, heat and biogeochemical properties. The Ligurian section crosses the DYFAMED position. Parameters: CTD, oxygen, phosphate, nitrate, silicate.

<u>Cruises actually carried out</u>: due to severe weather conditions, only a subset of the planned stations could be done in spring 2014 (see map, left). CNR will integrate the missing information in subsequent cruises planned for August 2015 in the framework of other European projects (planned station map is also shown, right). Those data will be transferred to the Perseus database as well as soon as available.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Mar14	37.3	43	8.8	12.3	Urania	K. Schroeder/Medocc14

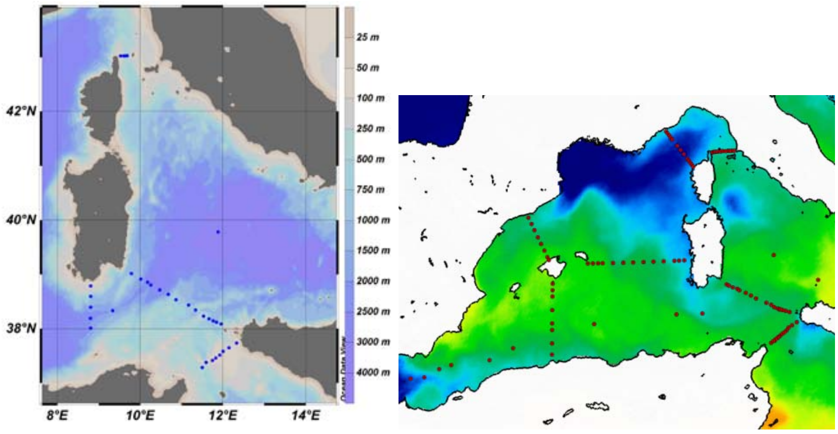


Figure 14. CNR cruise in 2014 (left), and approved cruise plan for August 2015 (right).

10) REPEATED CRUISES OR SECTIONS IN THE WESTERN MEDITERRANEAN SEA: D) MOOSE ANNUAL CRUISES (PARTICIPANT: CNRS)

According to the DOW "Finally, an annual MOOSE cruise (May-June) with large scale sections (20nm between stations) across the whole sub-basin (France-Minorca-Sardinia-Corsica) for the long-term monitoring of the water masses (physical and biogeochemical characteristics, same parameters as monthly cruises). Data will be transferred to data centres in NRT (<24h) when possible and in delayed mode (6 months)."

According to the questionnaire (see Appendix): CNRS planned annual cruises starting in January 2012 and ending in December 2015 with the objective of observing the long-term evolution of the NW Mediterranean Sea in the context of the climate change and anthropogenic pressure (over > 10 yrs) in order to be able to detect and identify long-term environmental trend and anomalies of the marine ecosystem. Integrated and multi-scale observation networks must include both high frequency monitoring and near real-time measurements capabilities in order to precisely document the broad spectrum of temporal and spatial scales involved and to rely it on the main circulation features already identified (basin scale gyres, eddies, biogeochemical provinces). Parameters: CTD, oxygen, fluorescence (chlorophyll), and beam attenuation, nutrients, alkalinity, dissolved inorganic carbon, pelagic bacteria/micro-organisms, phytoplankton pigment.

Cruises actually carried out: all MOOSE operations have started and actually on-going. The annual cruises have been carried out in July 2012, June 2013 and July 2014. The next one is scheduled for July 2015. All data have been retrieved from Seadatanet. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Jul12	39.8	43.5	3.1	8.6	LeSuroit	P. Testor/MOOSE-GE12
Jun13	39.8	43.5	3.1	8.6	LeSuroit	P. Testor/MOOSE-GE13
Jul14	39.8	43.5	3.1	8.6	LeSuroit	P. Testor/MOOSE-GE14

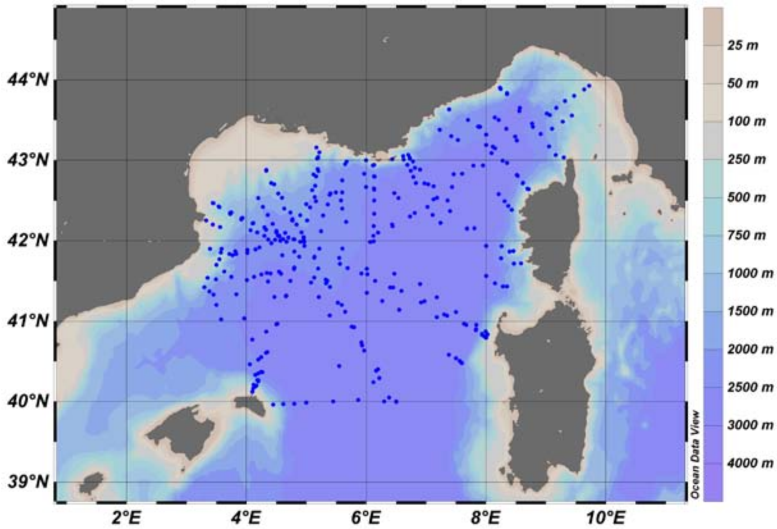


Figure 15. CNRS annual MOOSE cruises.

11) OTHER RELEVANT CRUISES LOCATED IN THE PERSEUS DATABASE AND SEADATANET DATABASE

OGS-ADREX: Within WP1.3, OGS participated to ADREX (Adriatic and Ionian Sea Experiment), and carried out three cruises in the Adriatic Sea. The cruise had the focus on the investigation of the role of the Adriatic-Ionian system in transmitting the human-made pressures in the eastern Mediterranean through the Adriatic Dense Water formation and spreading. Parameters: CTD, carbonate system, oxygen, nutrients, DOM, POM, CO2 uptake, biomass production and CO2 release, plankton productivity, biodiversity and carbon distribution in the trophic chain. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Mar13	41.2	42.25	17.11	18.5	OGS Explora	V. Cardin/ADREX13
Feb14	37	43.37	14.4	20.5	OGS Explora	G. Civitarese/ADREX14
Oct14	39.99	45.61	12.36	18.9	OGS Explora	V. Kovacevic/ADREX14sed

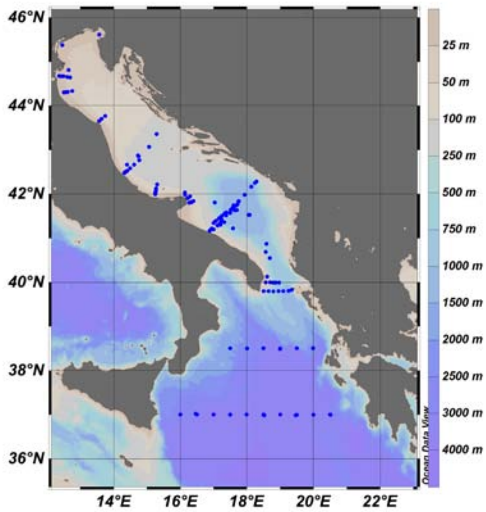


Figure 16. OGS ADREX cruises.

CNRS-SOMBA-GE14: CNRS organized a cruise in the Algerian Sea in August-September 2014. It is not part of Perseus but it covers an important part of the Mediterranean Sea, that has been identified in Subtask 3.1.3 as having a data gap. This is the main reason of its inclusion here. The main objective of SOMBA-GE is to start the companion time series of MOOSE for the
"Essential Oceanic Variables" in the Algerian Basin, with an extension and spatial scales coherent with the general circulation. As a matter of fact, although the Algerian Basin features (Algerian Current, anticyclonic eddies at surface, cyclonic gyres at depth, see below) are known to be essential for the spreading of the Mediterranean Atlantic Waters in the whole Mediterranean, and for the trophic regime of the Algerian Basin, only a few oceanographic cruises have been conducted in this region over the past decades and none of them have considered the area as an unique dynamical entity. Parameters: CTD, LADCP, ADCP, NO3, NO2, SiOH4, PO4, HPLC pigments analysis, dissolved inorganic carbon, dissolved oxygen (Winkler protocol) and pH. The cruise list and station map is shown below.

Period	Lat min	Lat max	Lon min	Lon max	R/V name	PI/Cruise name
Aug14	36.5	39.8	-0.7	9.5	LeSuroit	L. Mortier/SOMBA-GE14

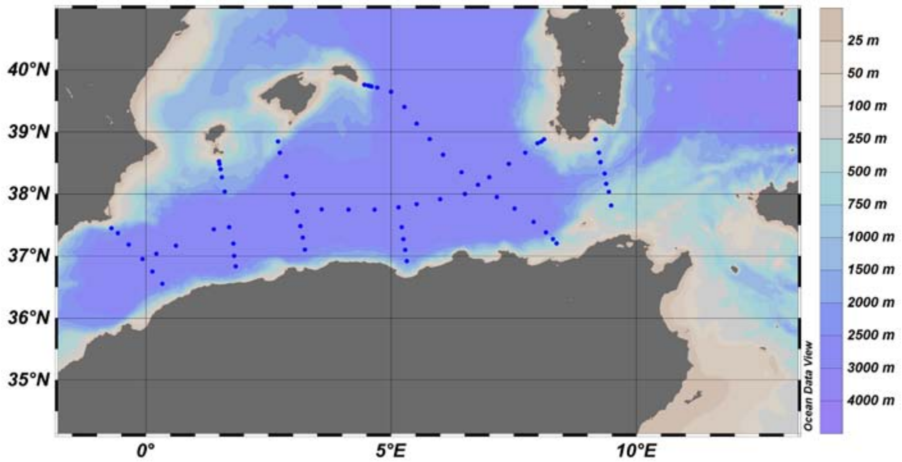


Figure 17. CNRS SOMBA-GE14 cruise.

SHODB Turkish cruises: The Department of Navigation and Hydrography and Oceanography (Turkish Navy) made also two extensive cruises programs available to international databases: SHODB12 cruises (monthly cruises at an irregular grid) and SHODB13 (almost monthly cruises at an irregular grid), for which not much metadata could have been located (they are not part of Perseus), but that cover an area for which in Task 3.1. a data gap has been highlighted, the north-eastern Levantine basin. The cruise station map is shown below.

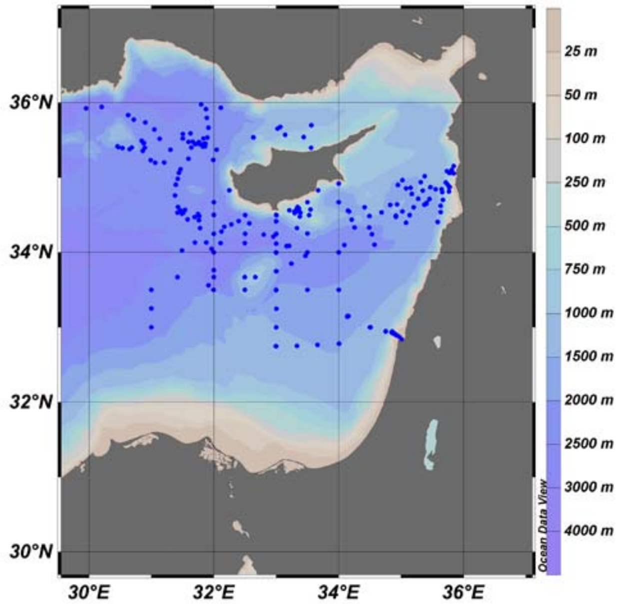


Figure 18. SHODB monthly cruises in 2012 and 2013.

3. Preliminary data analysis of the collected measurements

In this section some comments and plots on the collected data (mainly CTD data, leaving the description of other variables to the use and exploitation of the partners), to define the hydrological context of the working areas in the different subbasins. Some cruises were carried out "una tantum", while others are part of monthly or seasonal repetition programs. In the former case, transects of relevant properties in representative areas will be shown, while in the latter case a time series of properties will be constructed, evidencing the importance of sustained repeated hydrography. Contrary to the previous paragraph, here the description will follow a geographical criterion.

Hence, the content of the section has been structured over four sections:

1. Western Mediterranean
2. Adriatic and Ionian Seas
3. Levantine and Aegean Seas
4. Black Sea and Turkish Straits Systems

3.1. Western Mediterranean Sea

3.1.1. General characteristics

The Western Mediterranean (WMED) is directly connected to the Atlantic Ocean via the Strait of Gibraltar and is subdivided in two sub-basins, the Algero-Provencal basin and the Tyrrhenian Sea. Both areas may be further subdivided but mostly for geographical position, morphology at depth and/or dynamical features, without having sills or ridges separating them. Large eddies, especially those associated with the Atlantic Water flowing as a strong current (Algerian current) along the southern part of the basin and widespread mesoscale activity, with a typical smaller scale than in the open ocean, are another feature of the circulation. The continental shelf is generally very narrow with a few exceptions, e.g., the Gulf of Lion.
The Algero-Provencal Basin is characterized by a North-South gradient in primary production, due to the presence of a large scale cyclonic circulation in the North, the transition between the northern area and the southern part whose dynamics are strongly affected by the Atlantic Water. Overall the open WMED is oligotrophic, with the exceptions of Alboran and the Gulf of Lion, as well as some narrow coastal areas.
One of the key processes of the WMED is the deep water formation within the basin, with an impact on the transfer of matter and tracers at depth. This process can bring a large amount of carbon to depth.

3.1.2. Hydrographic description at selected transects (2012-2015)

In this area the most intense R/V activities are the repeated MOOSE, Canales and RADMED cruises. In addition there are one-time transects collected during Medocc14 (CNR), ALBOREX (IEO) and SOMBA-GE14 (CNRS).

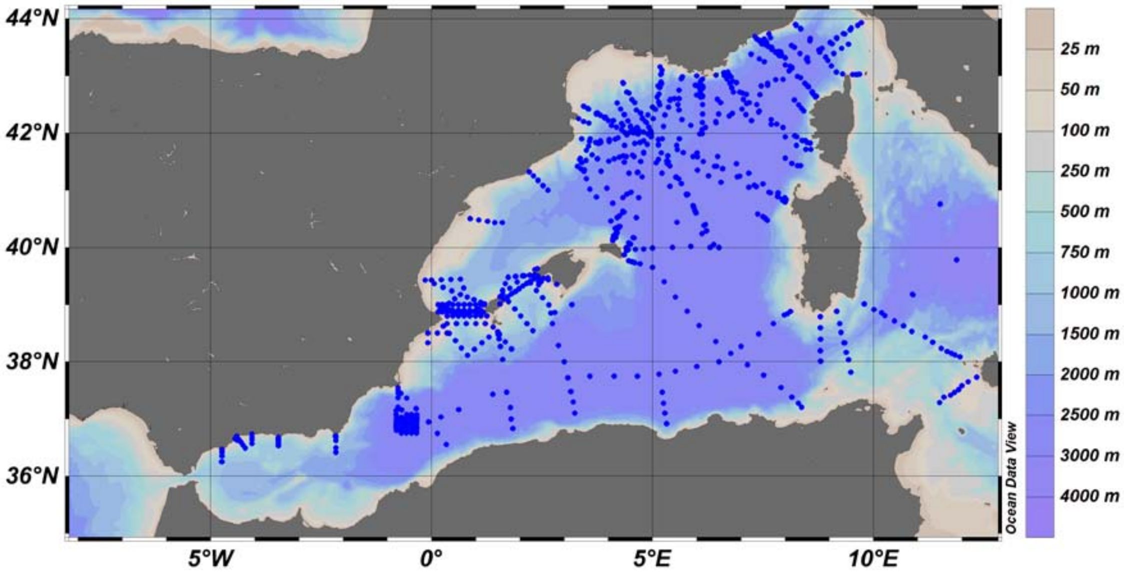


Figure 19. Cruises in the WMED during Perseus.

The TS diagram of the whole area is a very informative way to display water masses. Figure 20 shows all data (left) as well as a zoom on intermediate a deep layers (right). Pressure is colour-coded.

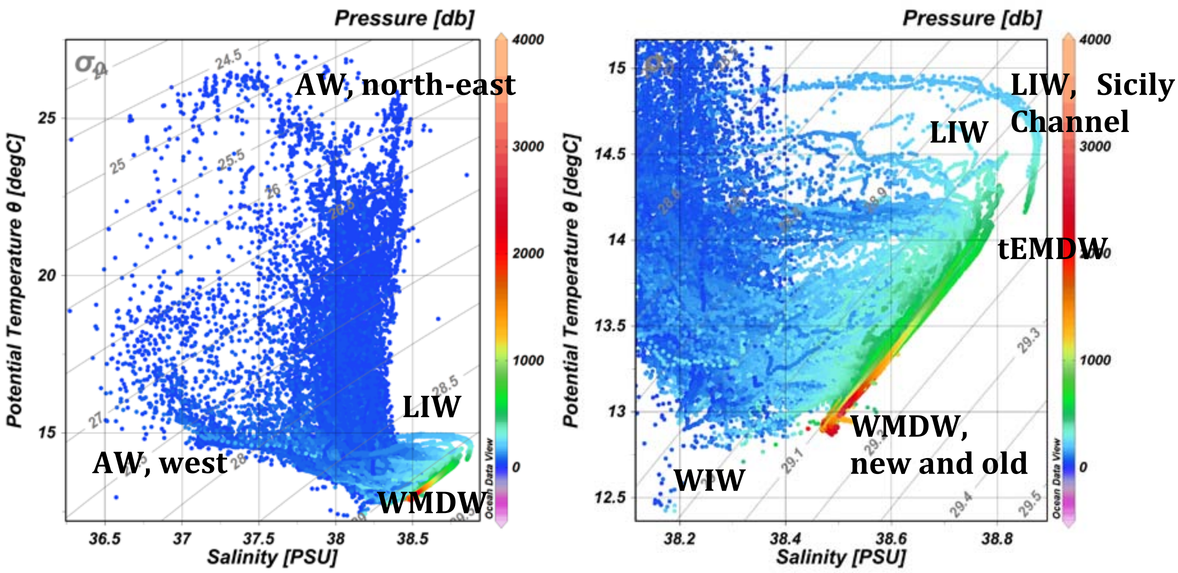


Figure 20. TS diagrams of the whole water column (left) and in the intermediate-deep layer (right) in the WMED during 2012-2015. (AW=Atlantic Water; LIW=Levantine Intermediate Water; WMDW=Western Mediterranean Deep Water; tEMDW=transitional Eastern Mediterranean Deep Water; WIW=Western Intermediate Water).

CNRS monthly cruises at DYFAMED provide a nice time series of deep vertical profiles. In figure 20 salinity is shown, which seems to increase with time in the intermediate layer.

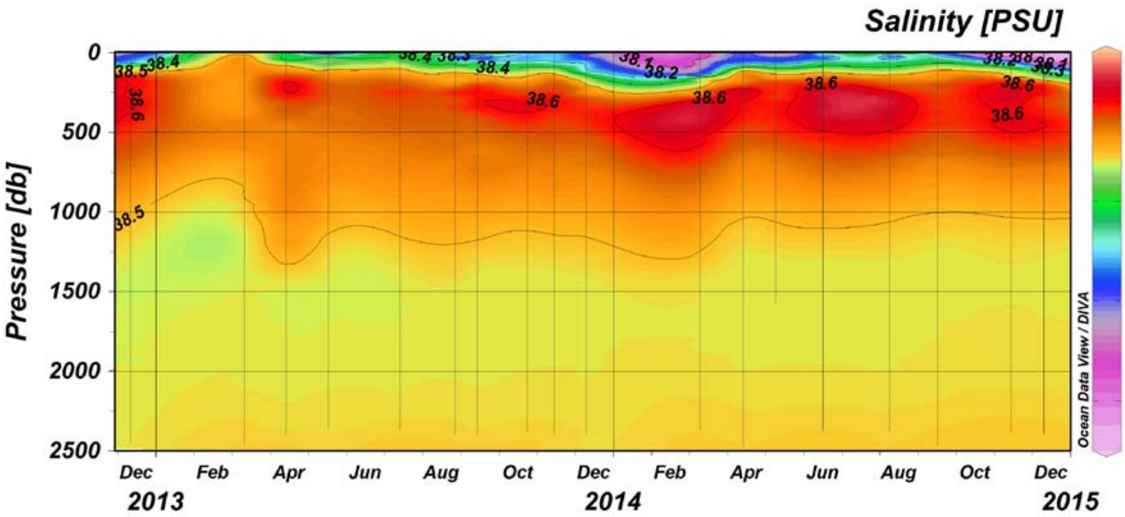


Figure 21. Hovmöller diagram of salinity at the Dyfamed station in the Ligurian Sea.

The SOMBA cruise in the Algerian subbasin provides us with the longest transect in the period, so salinity distribution along it is shown in Fig. 21, evidencing the decreasing salinity of the Levantine Intermediate Water from east to west, due to dilution with the overlying fresher Atlantic Water.

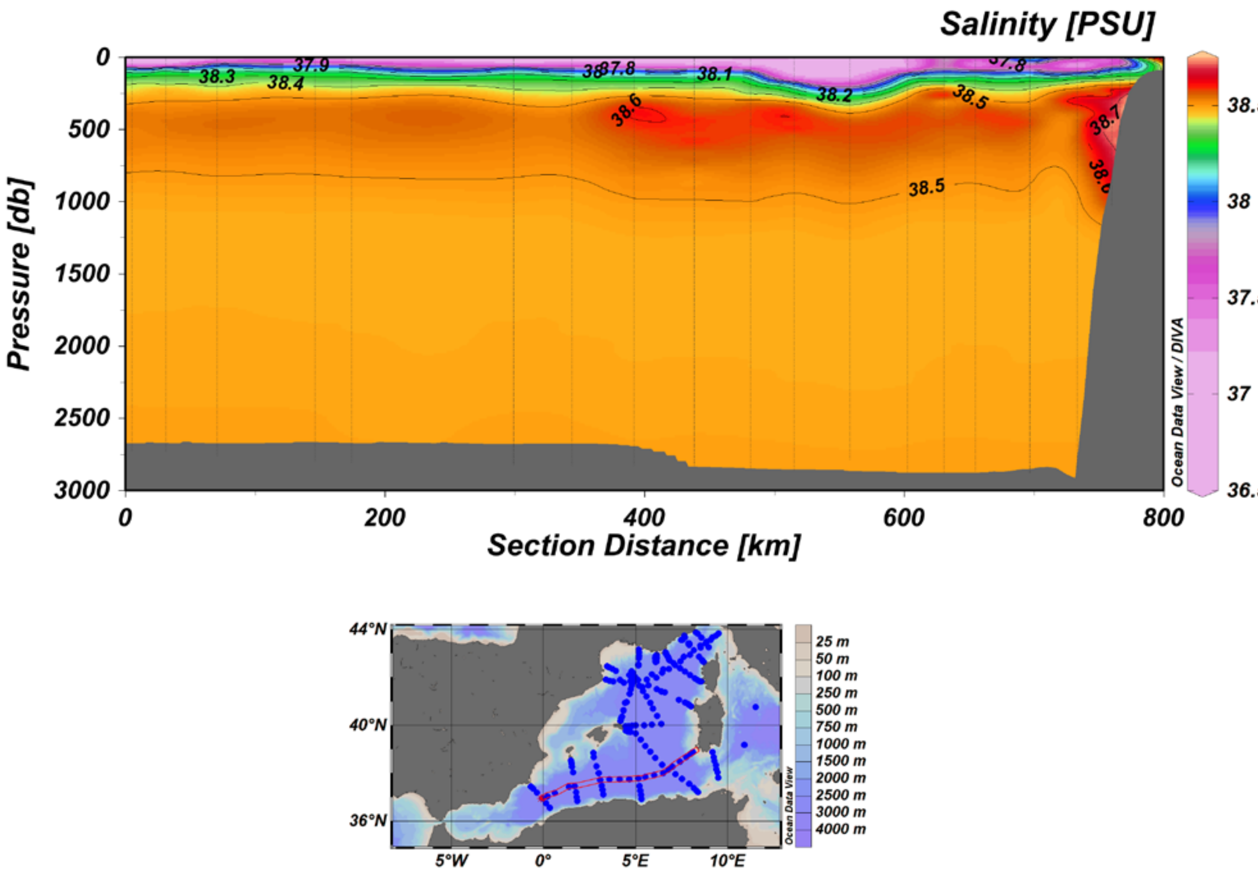


Figure 22. Salinity section along the Algerian transect.

IEO and SOCIB carried out seasonal cruises, and in Figure 23 we show the temporal evolution of temperature in one of the monitored channels (between Mallorca and

Ibiza), where the appearance and disappearance of the mixed layer is appreciable. Also the temperature of deeper waters seems to show some seasonal dependence.

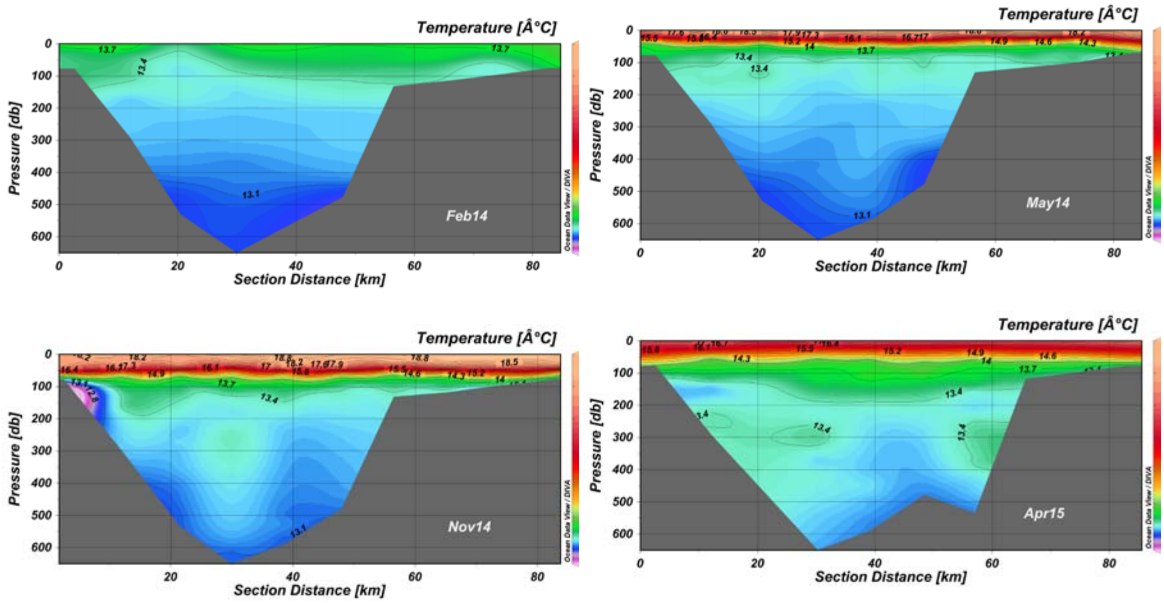


Figure 23. Seasonal evolution of temperature in the Mallorca-Ibiza Channel.

3.2. Adriatic and Ionian Seas

3.2.1. General characteristics

The Adriatic Sea is a semi-closed basin that stretches from the northern continental shelf (35 m of averaged depth) to the southern Adriatic Pit (1220 m of depth). The Adriatic is connected to the Ionian Sea through the Otranto Strait. The North Ionian Sea is featured by lower coastal development and human population than other areas of the Mediterranean Sea. On the other hand, the Adriatic Sea is affected by a significant runoff of continental waters and, because of its small surface and volume and morphology, is expected to be in the future one of the most impacted regions of the Mediterranean by the combined effects of climate changes and human activities. The Adriatic Sea plays an important role also for the large scale dynamics of the Eastern Mediterranean, being the site of formation of the dense water, which is the dominant component of the Eastern Mediterranean Deep Water. Recent analyses have also showed that the water exchange with the Ionian sea displays a Bimodal Oscillation which has a relevant effect on biogeochemical transports and therefore on the functioning of the ecosystem.

3.2.2. Hydrographic description at selected transects (2012-2015)

In this area the sole R/V activities are those carried out by OGS in the framework of ADREX (see Figure 16). In Figure 24 the TS diagrams are shown (whole water column and zoom), from which the very fresh water ($32<S<36$) found in front of the Po River, in the Northern Adriatic Sea, is evident, as well as the very dense water ($29.3<\sigma<29.7$) that was found in March 2013 in the Mid-Adriatic.

During Adrex14sed, in October 2014, the whole Italian shelf, from north to south has bee sampled. This gives us way to illustrate the strong salinity gradients that exist in the basin, due to the presence of the Po River in the very north of the Adriatic Sea (see Fig. 25), and the entrance, to the south, of salty surface water.

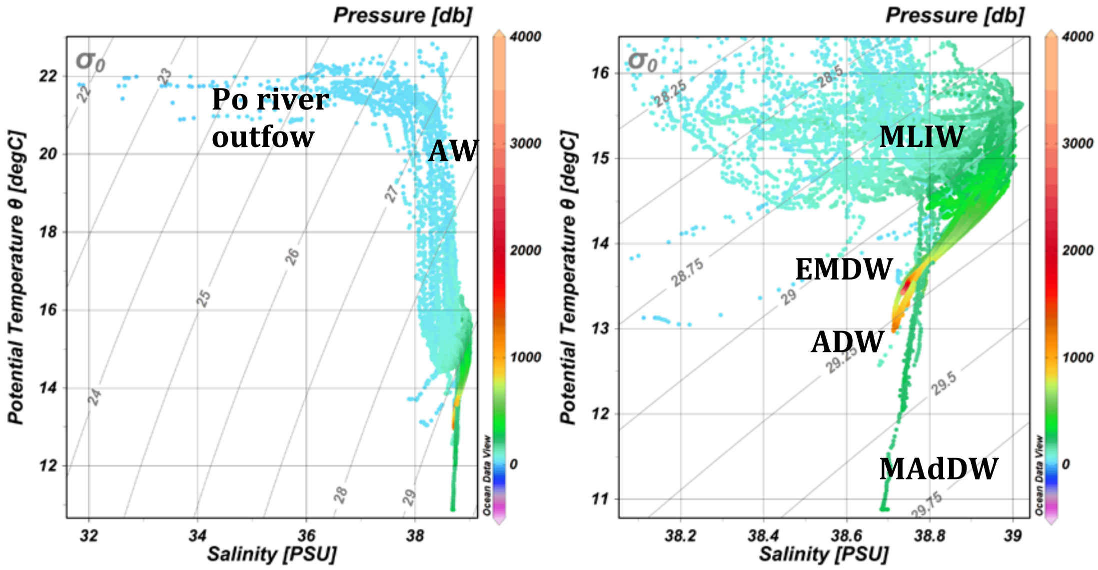


Figure 24. TS diagrams of the whole water column (left) and in the intermediate-deep layer (right) in the Adriatic-Ionian during 2013-2014. (AW=Atlantic Water; MLIW=Modified Levantine Intermediate Water; ADW=Adriatic Deep Water; MAdDW=Mid-Adriatic Dense Water; EMDW=Eastern Mediterranean Deep Water).

During ADREX14, in February 2014, parallel transect from the Ionian to the Adriatic have been measured. In Fig. 26 the evolution of potential temperature along three of these transects is shown.

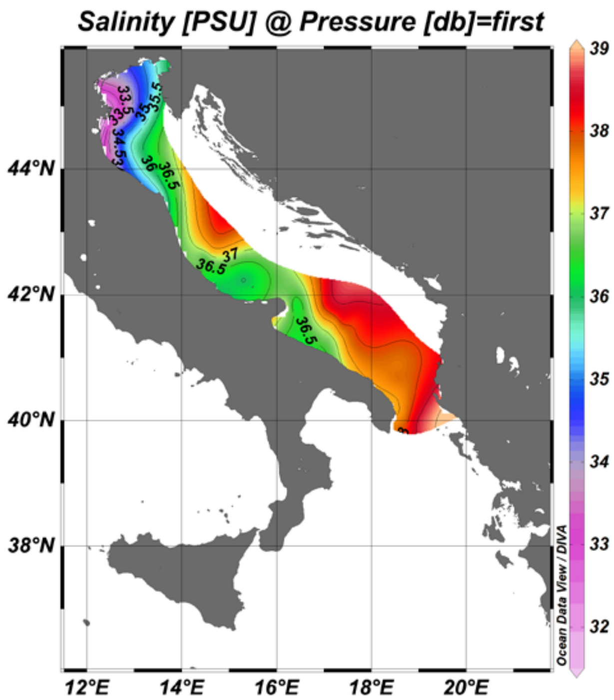


Figure 25. Potential temperautre distribution in February 2014 along three transects (numbers refer to the numbers in the station map below).

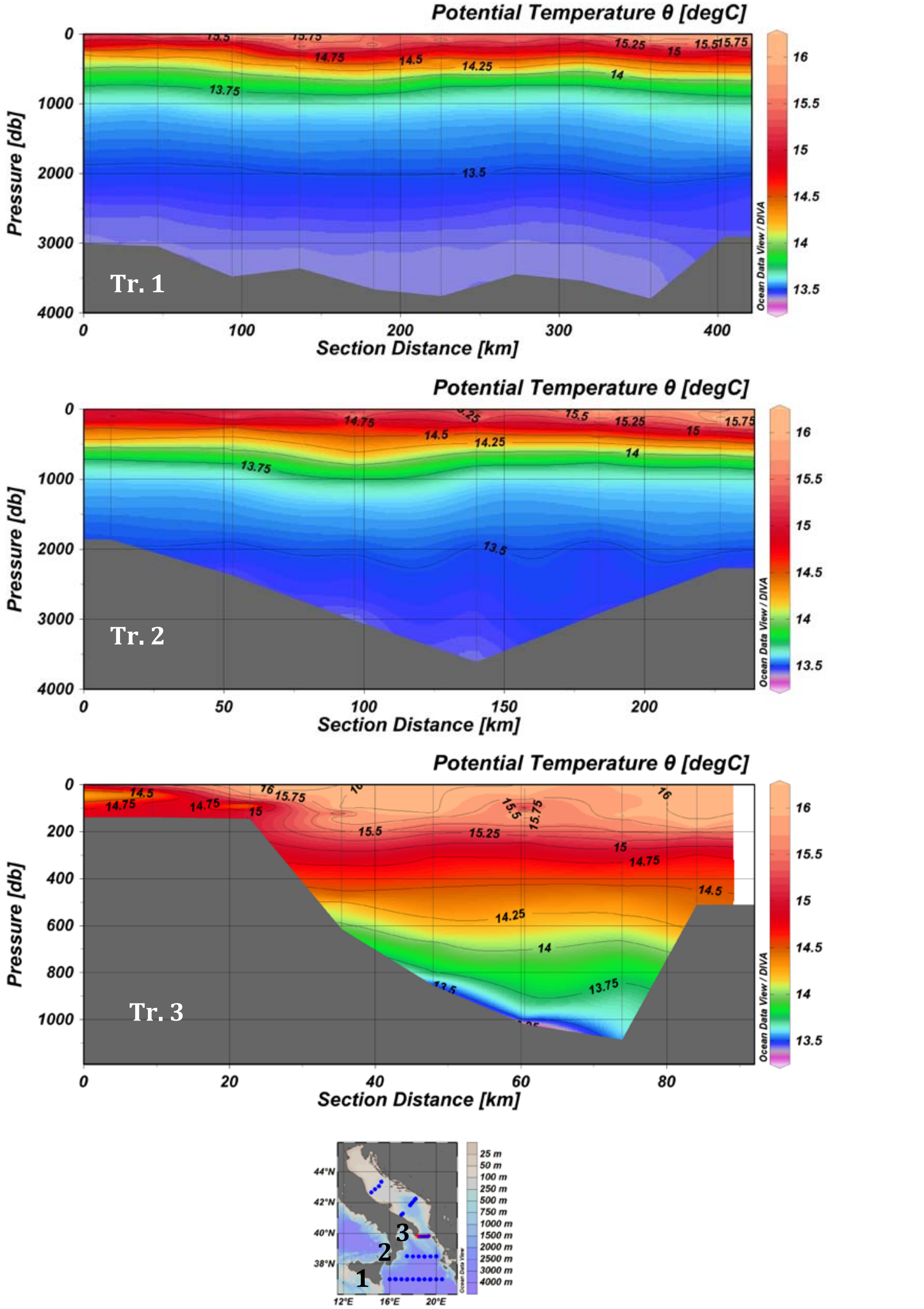


Figure 26. Potential temperautre distribution in February 2014 along three transects (numbers refer to the numbers in the station map below).

3.3. Levantine and Aegean Seas

3.3.1. General characteristics

The formation of water masses in the Mediterranean Sea generally slightly differs from season to season but can be stable due to predominance north-westerly winds throughout the year. During the summer, The Levantine basin is covered by the Levantine Surface Water (LSW), above the Atlantic Water layer characterized by a salinity minimum. The LSW water mass is formed by intensive heating and evaporation and has the largest salinity and temperature of the entire Mediterranean Sea. Due to general cyclonic circulation of the Levantine Basin the LSW advects to the Rhodes gyre region and due to its large salinity appears to be the source water for the Levantine Intermediate Water. Moreover, via the Cretan Arc passages, the LSW advects into eastern shelf of the Aegean Sea and participates in the intermediate and deep waters formation of the Aegean Sea.

The Aegean Sea is an elongated embayment of the Mediterranean Sea between the mainlands of Greece and Turkey. In the north, it is connected to the Marmara Sea and Black Sea by the Dardanelles and Bosphorus. Aegean surface water circulates in a counter-clockwise gyre, with hypersaline Mediterranean water moving northward along the west coast of Turkey, before being displaced by less dense Black Sea outflow. The dense Mediterranean water sinks below the Black Sea inflow to a depth of 23–30 metres, then flows through the Dardanelles Strait and into the Sea of Marmara. The Black Sea outflow moves westward along the northern Aegean Sea, then flows southwards along the east coast of Greece. The physical oceanography of the Aegean Sea is controlled mainly by the regional climate, the fresh water discharge from major rivers draining south-eastern Europe, and the seasonal variations in the Black Sea surface water outflow through the Dardanelles Strait. In the Aegean there are three distinct water masses: Aegean Sea Surface Water (40–50 metres), Aegean Sea Intermediate Water (from 40–50 m to 200–300 metres) with temperatures ranging from 11–18 °C and Aegean Sea Bottom Water occurring at depths below 500–1000 m with a very uniform temperature (13–14 °C) and salinity (39.1-39.2).

3.3.2. Hydrographic description at selected transects (2012-2015)

In this area the R/V activities are those carried out by HCMR in the Aegean Sea, by IOLR and OC-UCY and SHODB in the Levantine Sea (see Figure 27). In Figure 28 the TS diagrams for the Aegean Sea are shown (whole water column and zoom), and in Figure 29 the TS diagrams for the Levantine Sea are shown (whole water column and zoom).

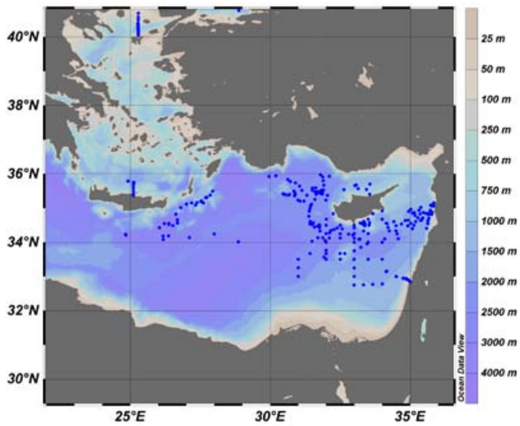


Figure 27. Station map in the Levantine and Aegean Seas

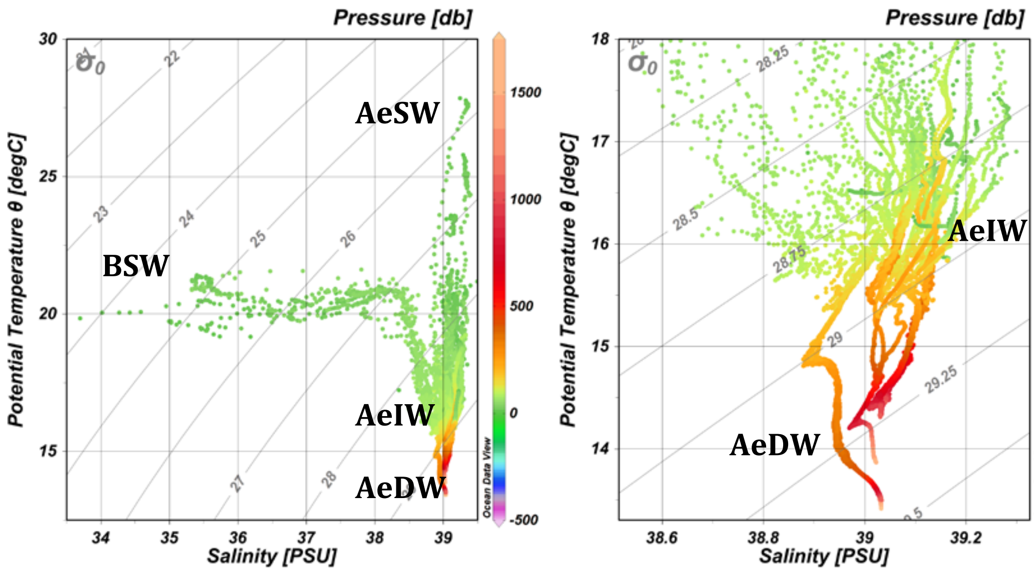


Figure 28. TS diagrams of the whole water column (left) and in the intermediate-deep layer (right) in the Aegean Sea during 2012-2015. (BSW=Black Sea Water; AeSW=Aegean Surface Water; AeIW=Aegean Intermediate Water; AeDW=Aegean Deep Water).

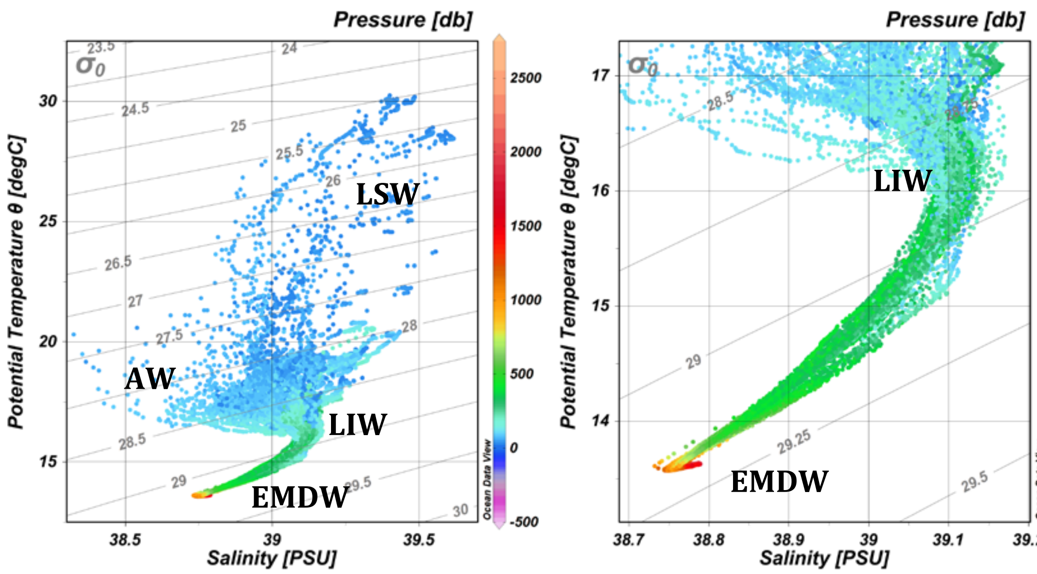


Figure 29. TS diagrams of the whole water column (left) and in the intermediate-deep layer (right) in the Levantine Sea during 2012-2015. (LSW=Levantine Surface Water; AW=Atlantic Water; LIW=Levantine Intermediate Water; EMDW=Eastern Mediterranean Deep Water).

In the southern Aegean Sea, HCMR performs monthly cruises to the E1-M3A buoy, and this gives us the opportunity to construct a time series of water mass properties in this area (Figure 30). The evolution of potential temperature nicely show the formation and disruption of the seasonal thermocline.

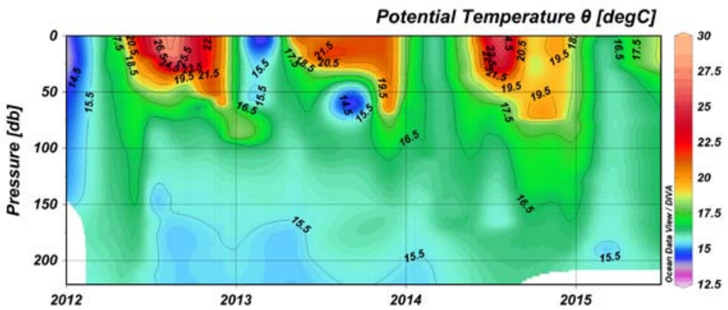


Figure 30. Hovmöller diagram of potential temperature at the E1-M3A station in the South Aegean Sea.

The CYBO 33°E line is aimed at tracking the Atlantic water flow towards the east. This water mass is usually identified by a subsurface salinity minimum, found below a salty and warm layer of Levantine Surface Water (Figure 31).

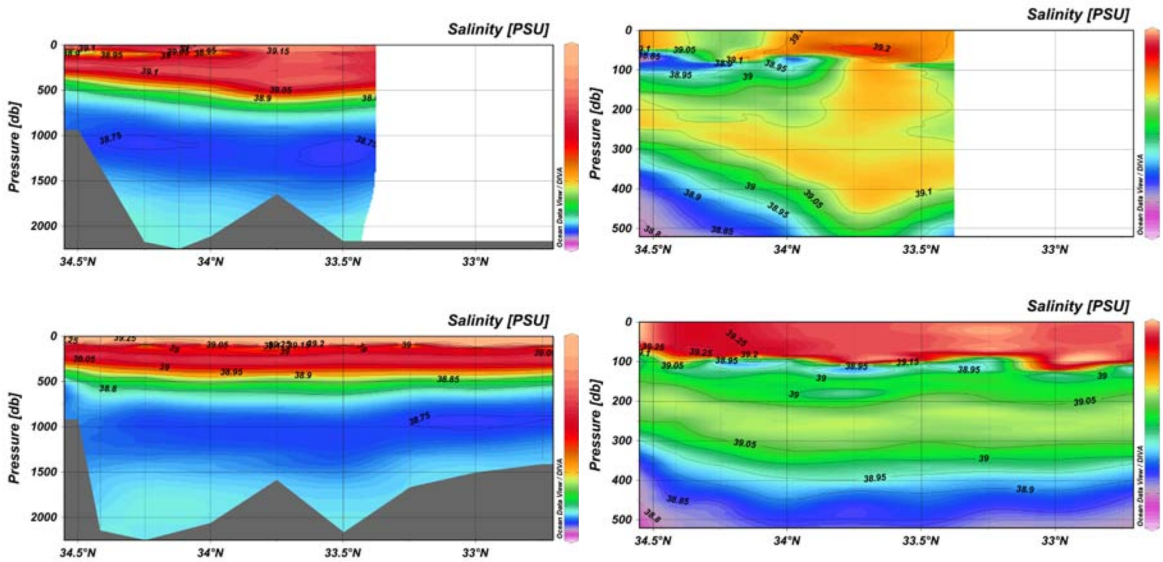


Figure 31. (above) Salinity distribution of the whole water column (left) and in the first 500 m (right) along the 33°E line in december 2012; (below) salinity distribution of the whole water column (left) and in the first 500 m (right) along the 33°E line in december 2013.

The Haifa repeated section provides an insight on shelf-offshore patterns, and here as an example we show the fluorescence (a proxy for Chl-a, hence primary production) distribution from the coastal area (where it is the highest) to almost 100 km offshore (Figure 32).

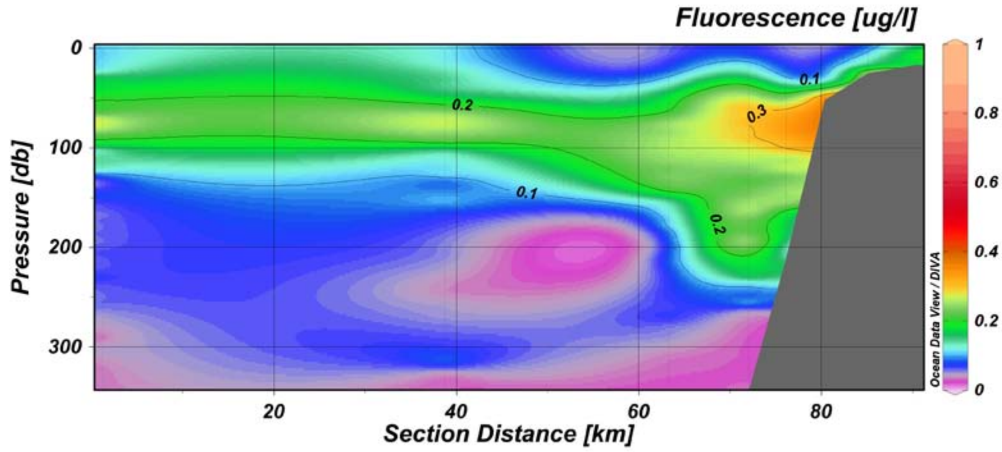


Figure 32. Fluorescence distribution along the Haifa Section in the first 320 m, March 2015.

3.4. Black Sea and Turkish Straits System

3.4.1. General characteristics

The Sea of Marmara is a unique area in the world surrounded by the lands of only one country. It is connected to the Black Sea via the Istanbul Strait (Bosphorus) and to the Mediterranean Sea through the Çanakkale Strait. The chemical oceanography of the Sea of Marmara is significantly influenced by the Black and Aegean Seas. The Sea of Marmara has eutrophic characteristics and is ecologically oxygen deficient in its deep layers; hence it is endangered by the potential developing of anoxia conditions associated with the progressing eutrophication of this basin and the adjacent seas. The Black Sea is a deep (about 2 km) marginal basin. There are narrow openings to the shallow Bosphorus Strait at the south that connects the Black Sea with the Marmara Sea, and to the north is the Kerch Strait linking the BS with the Azov. The Black Sea is notorious for its poor ecological conditions, which result from limited water exchange with the Eastern Mediterranean basin, weak vertical mixing due to the strong density (salinity) stratification and negligible tides, and enhanced nutrient enrichment/contamination by river discharges, urban/rural and tourist resort wastes, and pollution discharges from ports and especially from oil terminals, not to also underestimate the ship-borne pollution from ships and oil/gas exploration.

3.4.2. Hydrographic description at selected transects (2012-2015)

In this area the R/V activities are those carried out by METU, MHI and SIORAS in the framework of MAREX and BSEX experiments (WP1). The complete station map is shown in Figure 4. In Figure 33 the TS diagrams are shown (Black Sea and Marmara Sea, notice the very different ranges of salinities in these two basin, and compare them with the previously shown TS diagrams).

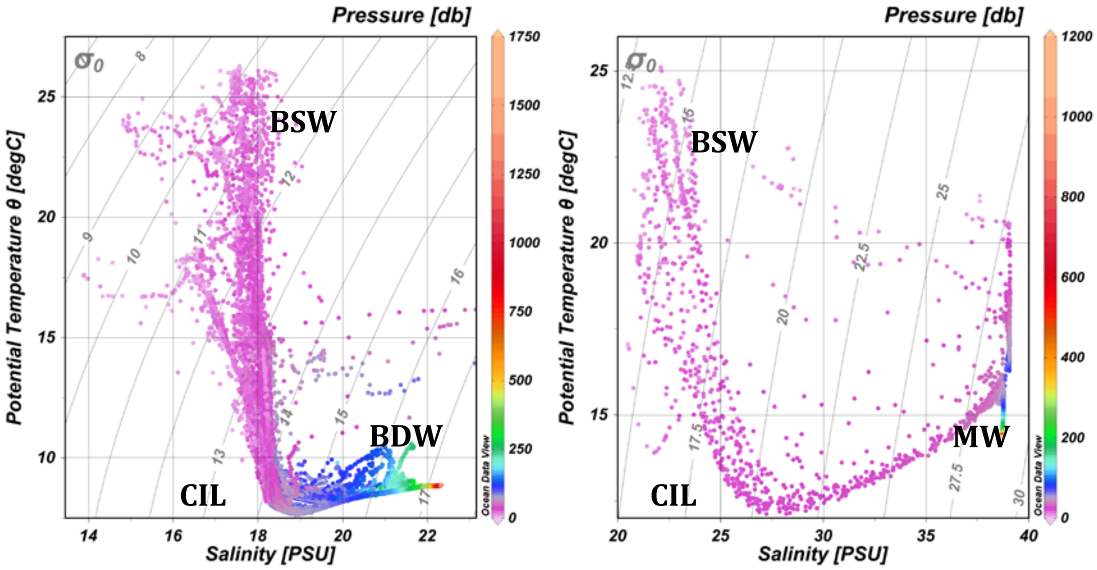


Figure 33. TS diagrams of the whole water column in the Black Sea (left) and in Marmara Sea (right) during 2013-2014. (BSW=Black Sea Surface Water; CIL=Cold Intermediate Layer; BDW=Black Sea Deep Water; MW= Mediterranean Water).

MHI performed a cruise in the north-western part of the Black Sea, with a very high resolution sampling schemes, that allows to produce reliable surface plots of property distribution. The same is true for the MAREX data, where the bottom salinity distribution shows the strong gradients between waters of Mediterranean origin and waters of Black Sea origin (Figure 34).

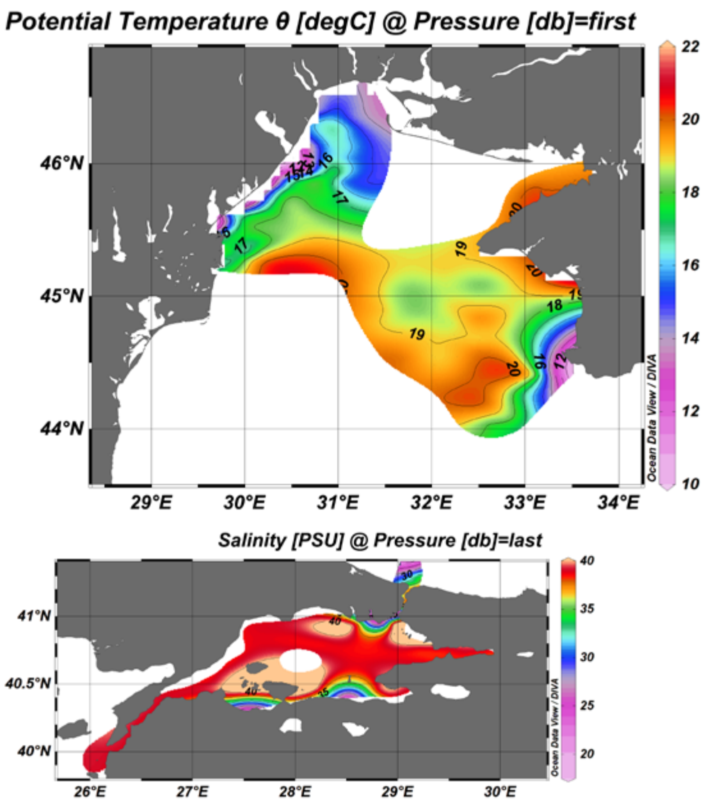


Figure 34. Surface distribution of temperature in September 2013, in the norht-western Black Sea (left); bottom salinity distribution in the Marmara Sea in June 2013.

During the BSEX cruise parallel transect following the cyclonic rim current in the Black Sea have been performed, and in Figure 35 the potential temperature section from the coastal to the open sea, along the 37.54 °E line is shown as an example, where the Cold Intermediate Layer is well evident.

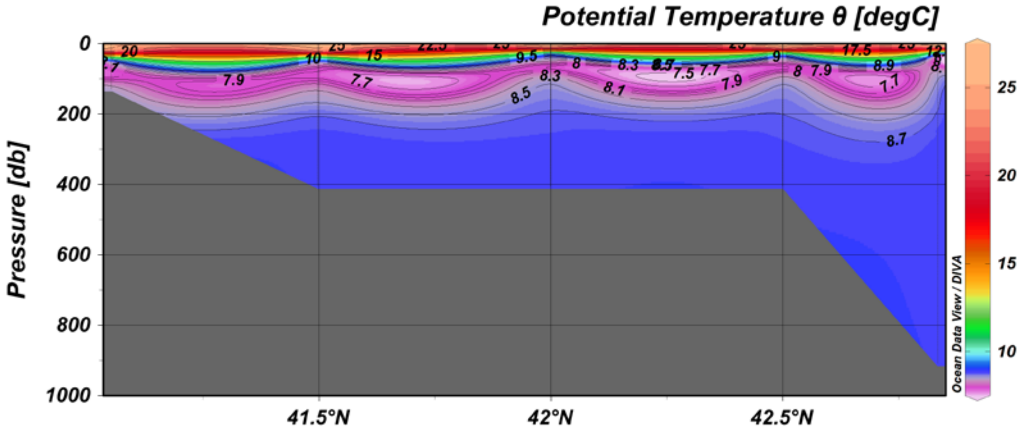


Figure 35. Vertical potential temperature distribution along a south-north transect at 37.54 °E.

4. CONCLUSIONS

The activities planned in subtask 3.2.3 of PERSEUS have allowed to upgrade and improve significantly the observing capacity of the SES by means of the ship based component of the Observing System. All the data collected are being made available through the Perseus database, and all CTD data will possibly flow into open-access databases, such as Coriolis. Improvements were twofold: the overall coordination between cruises, that were planned in advance, sharing the plans with the partners (see results from questionnaires in the appendix) and the general expansion of geographical coverage. However comparing Fig. 3 with Fig. 2 it appears that the gaps have been filled only partially, substantial improvement is to be highlighted for the Algerian Basin, the north-western Mediterranean, the north-eastern Mediterranean as well as for the Black Sea. The southern Ionian Sea is still under-sampled (not sampled at all during Perseus), but this has to be mainly ascribed to political issues and ongoing conflicts in the southern shore countries, which became a particular critical issue during the whole part of the project duration.

APPENDIX 1: QUESTIONNAIRES

SIORAS questionnaire on planned cruises

PERSEUS WP3

R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises:

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

03/2013
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

10/2015
month/ year

Frequency (monthly, seasonal etc)
Six cruises per year

Duration of each cruise (number of days approximately)
One day

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: Shirshov Institute of Oceanology RAS

Address: 36 Nakhimovskii pr., 117997 Moscow

Country: Russia

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

Name: Viacheslav Kremenetskiy

email: SK@ocean.ru

Laboratory: Laboratory of experimental physics of ocean

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

Viacheslav Kremenetskiy

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The principal objective of the cruises are to contribute in the creation of time series of hydrophysical, hydrochemical and biological parameter measurements along the transect across the coastal zone off Gelendzhik (NE Black Sea) to study major circulation features of coastal dynamics and its influence on the ecosystem.

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: Fundamental problems of ocean: physics, geology, biology, ecology.

Project type (institutional, national, international): national

Coordinating body: Presidium of Russian Academy of Sciences

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. Kremenetskiy Vyacheslav (sk@ocean.ru)

B. Arashkevich Elena (aelena@ocean.ru)

C. Romanova Nadya (romanova-nadya@yandex.ru)

D. Nikishina Anastasia (anastasia.nikishina@gmail.com)

E. Drits Alexander (adrits@mail.ru)

F. Ostrovskiy Alexander (osasha@ocean.ru)

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI	APPROXIMATE POSITION						DATA TYPE	DESCRIPTION
	LATITUDE			LONGITUDE				
See top of page.	deg	min	N/S	deg	min	E/W	enter Roscop code(s) from the list on next pages	Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
A	44	5673	N	37	9851	E	H10	CTD cast from 0m to the bottom (pressure, temperature, conductivity, fluorescence, light transmission, irradiance (PAR), depth, salinity, density Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H22	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Phosphate measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H24	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Nitrate measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H25	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Nitrate measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H76	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Ammonia measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H26	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Silicate measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H27	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Alkalinity measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	H28	Niskin bottle at Depths: 1, 10, 20, Chl-a max. pH measurements Station Perseus-1 (~25m bottom depth)
C	44	5673	N	37	9851	E	B07	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Pelagic bacteria/micro-organisms measurements Station Perseus-1 (~25m bottom depth)
D	44	5673	N	37	9851	E	B02	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Phytoplankton pigment measurements Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	B08	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Phytoplankton species composition measurements Station Perseus-1 (~25m bottom depth)
E	44	5673	N	37	9851	E	B09	Two nets from the bottom to surface. Zooplankton abundance and species composition measurements. For mesozooplankton – a Juday net (37 cm mouth diameter, 180 μm mesh size), for macrozooplankton including gelatinous organisms – a conical net ((80 cm mouth diameter, 400 μm mesh size) Station Perseus-1 (~25m bottom depth)
B	44	5673	N	37	9851	E	B71	Niskin bottle at Depths: 1, 10, 20, Chl-a max. Particulate organic matter (POC, PON) measurements Station Perseus-1 (~25m bottom depth)
A	44	5505	N	37	9760	E	H10	CTD cast from 0m to the bottom (pressure, temperature, conductivity, fluorescence, light transmission, irradiance (PAR), depth, salinity, density Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H22	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Phosphate measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H24	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Nitrate measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H25	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Nitrate measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H76	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Ammonia measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H26	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Silicate measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H27	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Alkalinity measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	H28	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. pH measurements Station Perseus-2 (~50m bottom depth)
C	44	5505	N	37	9760	E	B07	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Pelagic bacteria/micro-organisms measurements Station Perseus-2 (~50m bottom depth)
D	44	5505	N	37	9760	E	B02	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Phytoplankton pigment measurements Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	B08	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m. Phytoplankton species composition measurements Station Perseus-2 (~50m bottom depth)
E	44	5505	N	37	9760	E	B09	Two nets from the bottom to surface. Zooplankton abundance and species composition measurements. For mesozooplankton – a Juday net (37 cm mouth diameter, 180 μm mesh size), for macrozooplankton including gelatinous organisms – a conical net ((80 cm mouth diameter, 400 μm mesh size) Station Perseus-2 (~50m bottom depth)
B	44	5505	N	37	9760	E	B71	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50m.Particulate organic matter (POC, PON) measurements Station Perseus-2 (~50m bottom depth)
A	44	5375	N	37	9698	E	H10	CTD cast from 0m to the bottom (pressure, temperature, conductivity, fluorescence, light transmission, irradiance (PAR), depth, salinity, density Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H22	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Phosphate measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H24	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Nitrate measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H25	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Nitrate measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H76	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Ammonia measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H26	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Silicate measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H27	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Alkalinity measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	H28	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. pH measurements Station Perseus-3 (~100m bottom depth)
C	44	5375	N	37	9698	E	B07	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m. Pelagic bacteria/micro-organisms measurements Station Perseus-3 (~100m bottom depth)
D	44	5375	N	37	9698	E	B02	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton pigment measurements Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	B08	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton species composition measurements Station Perseus-3 (~100m bottom depth)
E	44	5375	N	37	9698	E	B09	Two nets from the bottom to surface. Zooplankton abundance and species composition measurements. For mesozooplankton – a Juday net (37 cm mouth diameter, 180 μm mesh size), for macrozooplankton including gelatinous organisms – a conical net ((80 cm mouth diameter, 400 μm mesh size) Station Perseus-3 (~100m bottom depth)
B	44	5375	N	37	9698	E	B71	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Particulate organic matter (POC, PON) measurements Station Perseus-3 (~100m bottom depth)
A	44	5246	N	37	9645	E	H10	CTD cast from 0m to the bottom (pressure, temperature, conductivity, fluorescence, light transmission, irradiance (PAR), depth, salinity, density Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H22	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Phosphate measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H24	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Nitrate measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H25	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Nitrate measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H76	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Ammonia measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H26	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Silicate measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H27	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Alkalinity measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	H28	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. pH measurements Station Perseus-4 (~200m bottom depth)
C	44	5246	N	37	9645	E	B07	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Pelagic bacteria/micro-organisms measurements Station Perseus-4 (~200m bottom depth)
D	44	5246	N	37	9645	E	B02	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton pigment measurements Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	B08	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton species composition measurements Station Perseus-4 (~200m bottom depth)
E	44	5246	N	37	9645	E	B09	Two nets from sigma-theta 16.2 to surface. Zooplankton abundance and species composition measurements. For mesozooplankton – a Juday net (37 cm mouth diameter, 180 μm mesh size), for macrozooplankton including gelatinous organisms – a conical net ((80 cm mouth diameter, 400 μm mesh size) Station Perseus-4 (~200m bottom depth)
B	44	5246	N	37	9645	E	B71	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Particulate organic matter (POC, PON) measurements Station Perseus-4 (~200m bottom depth)
A	44	5125	N	37	9591	E	H10	CTD cast from 0m to the bottom (pressure, temperature, conductivity, fluorescence, light transmission, irradiance (PAR), depth, salinity, density Station Perseus-5 (~500m bottom depth)
B	44	5125	N	37	9591	E	H22	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Phosphate measurements Station Perseus-5 (~500m bottom depth)
B	44	5125	N	37	9591	E	H24	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Nitrate measurements Station Perseus-5 (~500m bottom depth)

3

								Station Perseus-5 (~500m bottom depth)
B	44	5125	N	37	9591	E	H28	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. pH measurements Station Perseus-5 (~500m bottom depth)
C	44	5125	N	37	9591	E	B07	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 100m, oxic/anoxic layer. Pelagic bacteria/micro-organisms measurements Station Perseus-5 (~500m bottom depth)
D	44	5125	N	37	9591	E	B02	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton pigment measurements Station Perseus-5 (~500m bottom depth)
B	44	5125	N	37	9591	E	B08	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Phytoplankton species composition measurements Station Perseus-5 (~500m bottom depth)
E	44	5125	N	37	9591	E	B09	Two nets from sigma-theta 16.2 to surface. Zooplankton abundance and species composition measurements. For mesozooplankton – a Juday net (37 cm mouth diameter, 180 µm mesh size), for macrozooplankton including gelatinous organisms – a conical net ((80 cm mouth diameter, 400 µm mesh size) Station Perseus-5 (~500m bottom depth)
B	44	5125	N	37	9591	E	B71	Niskin bottle at Depths: 1, 10, 20, Chl-a max, 50, 75m. Particulate organic matter (POC, PON) measurements Station Perseus-5 (~500m bottom depth)
F	44	2944	N	37	5838	E	H10, D71	Anchored profiler Aqualog, CTD and ADCP casts from 20 m depth down to 250 m depth, 4-6 times per day.

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Black Sea

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Mardsen square **177;2**

MHI questionnaire on planned cruises

PERSEUS WP3

R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises: 2 R/V "Professor Vodyanitsky" and 3 cruises on small-size ship.

Starting date: (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

08/2013
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

11/2013
month/ year

Frequency (monthly, seasonal etc)
Seasonal for R/V "Professor Vodyanitsky" and monthly for small-size ship.

Duration of each cruise (number of days approximately)
10 days for R/V "Professor Vodyanitsky and 2-3 days for small-size ship

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: Marine Hydrophysical Institute, (MHI)

Address: 2, Kapitanskaya St., Sevastopol, 99011, Ukraine

Country: Ukraine

RESPONSIBLE COORDINATING SCIENTIST

Name: Vitaliy Ivanov
email: Vaivanov@inbox.ru

Laboratory: Marine Hydrophysical Institute, (MHI)

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The main objective of the cruises are to contribute in measurements of optical, physical and biochemical parameters by using a Research vessel in the Western part of the Black Sea:

- monitoring along secular transection "Chersones - Bosporus";
- observations of transformation of Cold Intermediate Layer;
- study of seasonal evolution of Sevastopol anticyclonic eddy;
- hydrological observations in coastal zone near Dnestr and Danube estuaries and near Zmeinuy island with the aim to study of river water transformation in summer period;
- vertical profiling of currents by ADCP;

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: Marine Programme

Project type (institutional, national, international): Institutional and National

Coordinating body: Marine Hydrophysical Institute

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. to be identify later

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI	APPROXIMATE POSITION						DATA TYPE	DESCRIPTION
	LATITUDE			LONGITUDE				
See top of page.	deg	min	N/S	deg	min	E/W	enter Roscop code(s) from the list on next pages	Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
A	45	30	N	30	30	E	H10	**Around 50 CTD casts from 0 to 150 m on the shelf and till 500m over the shelf margin (pressure, temperature, conductivity, oxygen , light transmission, , depth, salinity, density**
B	45	30	N	30	30	E	H22	**Stations: bottle at Depths: 1, 10, 20, 50, 75, 100. Phosphate measurements**
C	45	30	N	30	30	E	H24	**Stations: bottle at Depths: 1, 10, 20, 50, 75, 100. Nitrate measurements**
C	45	30	N	30	30	E	H25	**Stations: bottle at Depths: 1, 10, 20, 50, 75, 100. Nitrite measurements**
C	45	30	N	30	30	E	D71	**Around 50 lowered ADCP casts from 0 to 150 m on the shelf and till 500m over the shelf margin (pressure, temperature, current velocity)**
C	44	00	N	32	30	E	D05	**Four thermo-profile floats will be deployed in 2013 by the MHI funds: > 1 float - in summer, > 3 floats in Nov-Dec.**

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Black Sea

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Black Sea
Mardsen square (177;1), (177,2)

The Black Sea is the largest inland sea and deepest basin (~2200 m). The hydrological structure in the Black Sea is dominated by multiple scale circulation patterns and is forced by the buoyancy fluxes drived by the river discharge and water exchange through the Bosporus Strait and Strait of Kerch. The circulation in the Black Sea is dictated by the combined effect of two gyres features and Rim current. The Black Sea has an extensive anoxic zone and Cold Intermediate Layer.

The location of the casts at the Black Sea was chosen, since permit to study of seasonal evolution of Sevastopol anticyclonic eddy and of river water transformation on the shelf and its impact on the shelf ecosystem.

HCMR questionnaire on planned cruises

PERSEUS WP3 R/V PRE-CRUISE PLANNING SUMMARY REPORT	

CRUISES FREQUENCY, DURATION

Total number of cruises:

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

01/2013
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

06/2015
month/ year

Frequency (monthly, seasonal etc)
Monthly

Duration of each cruise (number of days approximately)
One day

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: INSTITUTE OF OCEANOGRAPHY, HELLENIC CENTRE FOR MARINE RESEARCH, HCMR

Address: Former American Base of Gournes, PO Box 2214, 71003, Heraklion, Crete

Country: GREECE

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

Name: FRANGOULIS CONSTANTIN
email: cfrangoulis@hcmr.gr

Laboratory: INSTITUTE OF OCEANOGRAPHY, HELLENIC CENTRE FOR MARINE RESEARCH, HCMR

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

FRANGOULIS CONSTANTIN

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The main objective of the cruises are to contribute in the creation of a times series of optical, physical and biochemical parameters measurements using a Research vessel at the location of the POSEIDON-E1-M3A buoy

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: POSEIDON-E1-M3A monitoring

Project type (institutional, national, international): institutional

Coordinating body: INSTITUTE OF OCEANOGRAPHY, HELLENIC CENTRE FOR MARINE RESEARCH

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. NTOUMAS MANOLIS

B. DAFNOMILI ELENI

C. ZIVANOVIC SNEZANA

D. PSARRA STELLA

E. PITTA VIVI

F. FRANGOULIS CONSTANTIN

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI	APPROXIMATE POSITION						DATA TYPE	DESCRIPTION
	LATITUDE			LONGITUDE				
See top of page.	deg	min	N/S	deg	min	E/W	enter Roscop code(s) from the list on next pages	Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
A	35	7837	N	24	9292	E	H10	Station POSEIDON-E1-M3A. CTD cast from 0 to 150 m (pressure, temperature, conductivity, oxygen, , fluorescence, light transmission, irradiance (PAR), depth, salinity, density
B	35	7837	N	24	9292	E	H22	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Phosphate measurements
C	35	7837	N	24	9292	E	H24	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Nitrate measurements
C	35	7837	N	24	9292	E	H25	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Nitrite measurements
C	35	7837	N	24	9292	E	H76	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Ammonia measurements
C	35	7837	N	24	9292	E	H26	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Silicate measurements
D	35	7837	N	24	9292	E	B02	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Phytoplankton pigments measurements
E	35	7837	N	24	9292	E	B07	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Pelagic bacteria/micro-organisms measurements
D	35	7837	N	24	9292	E	B08	Station POSEIDON-E1-M3A. Niskin bottle at Depths: 1, 10, 20, 50, 75, 100. Phytoplankton cells composition measurements
F	35	7837	N	24	9292	E	B09	Station POSEIDON-E1-M3A. 1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter). Zooplankton abundance and size measurements

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Cretan Sea

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Cretan Sea
Mardsen square 142;1

The Cretan Sea is the largest and deepest basin (2500 m) in the south Aegean Sea. The hydrological structure in the Cretan Sea is dominated by multiple scale circulation patterns and is an area of deep-water formation. It acts as a reservoir for heat and salt for the Eastern Mediterranean.
The circulation in the Cretan Sea is dictated by the combined effect of two gyral features, an anticyclonic eddy in the west and a cyclonic eddy in the east.
The location of the E1-M3A site at the Cretan Sea was chosen, since although close to the coast (~24 nm) it is an area of open sea conditions, characterised as extremely oligotrophic where dense waters with intermediate and deep characteristics are formed.

IOLR questionnaire on planned cruises

PERSEUS WP3
R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises: 08

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

01/2012
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

12/2015
month/ year

Frequency (monthly, seasonal etc) Twice per Year

Duration of each cruise (number of days approximately) 1 day

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: IOLR (Israel Oceanographic & Limnological Research)
Address: Tel-Shikmona, P.O.B. 8030, Haifa 31080
Country: ISRAEL

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

Name: Isaac Gertman
email: isaac@ocean.org.il
Laboratory: IOLR

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

Nurit Kress, IOLR
Isaac Gertman, IOLR

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The main objective of the "Haifa Section" project is to observe the long-term variability and evolution of the major water mass parameters in the South Easter corner of the Levantine Basin in the context of the climate change and anthropogenic pressure (over > 10 yrs).

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: HaiSec (Haifa Section)

Project type (institutional, national, international): institutional

Coordinating body: IOLR

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. Nurit Kress(IOLR) - data received by chemical analysis of water sampled by Niskin bottles

B. Isaac Gertman (IOLR) – CTD data

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

Plan coordinates for HaSec cruise

St. name	Depth [m]	Latitude N		Longitude E	
		deg	min	deg	min
H01	50	32	54.0	34	55.2
H02	200	32	55.2	34	52.8
H03	500	32	55.8	34	51.0
H04	1100	32	57.0	34	45.0
H05	1400	33	0.0	34	30.0
H06	1600	33	9.0	34	9.6

Each station is resulted in:
1. CTD data (H10) with sampling rate 1 db from 0 to bottom: water temperature, salinity, oxygen, fluorescence, light transmission (PI: B)
2. Niskin bottle data (H09) on selected levels: alkalinity, dissolved oxygen, nitrate, nitrite, nitrate+nitrite, phosphate, Ph, silicate, Chlorophil-a (PI: A)

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

28A. Med. Sea – Levantine Basin

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

South East part of the Levantine basin. The section is started near to Haifa and ended about 100 km from Haifa in the North West direction.

Marsden square : **141**

OC-UCYquestionnaire on planned cruises

PERSEUS WP3
R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises:

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

04/2012
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

12/2013
month/ year

Frequency (monthly, seasonal etc)
Bi-monthly and annual

Duration of each cruise (number of days approximately)

For bi-monthly cruises the duration is 1 day and for the annual cruises the duration is 3 and 10 days

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

For the bi-monthly and annual 3 days duration:
Name: OCEANOGRAPHY CENTER UNIVERSITY OF CYPRUS, OC-UCY
Address: BOX 20537, 1678 Nicosia
Country: CYPRUS

For the annual 10 days duration:
Name: AP MARINE ENVIRONMENTAL CONSULTANCY LTD
Address: Nicosia
Country: CYPRUS

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

For the bi-monthly and annual with duration 3 days:
Name: George Zodiatis
email: gzodiac@ucy.ac.cy
Laboratory: OCEANOGRAPHY CENTER UNIVERSITY OF CYPRUS, OC-UCY
For the annual cruises with duration of 10 days the above name in cooperation with the AP Marine Environmental Consultancy LTD

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises

YIANNA SAMUEL-RHOADS for the bi-monthlycruise

MARIOS NIKOLAIDES for the annual cruises with a duration of 10 days in cooperation with AP Marine Environmental Consultancy LTD

GEORGE ZODIATIS for the annual with duration 3 days

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The objective of the MEDZOO daily cruises is to obtain a bi-monthly times series of physical and biological parameters measurements of a coastal domain with up to 10 stations in the Limassol Bay, Levantine Basin.

The objectives of the annual MEDITS with 10 days duration cruises is to collect data for the evaluation of the benthic fish stock abundance in the waters of the Republic of Cyprus for the Period 2011-2013. OC-UCY is responsible for physical data collection, processing and analysis.

The objectives of the annual CYBO with 3 days duration cruises is to collect data along the Longitude of the 33' 00N in order to monitor the transport of the AW, of the Cyprus eddy and of the MMJ.

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: MedZOO

Project type (institutional, national, international): international

Coordinating body: CIESM

Project name: MEDITS 2011-2013

Project type (institutional, national, international): national

Coordinating body: AP MARINE ENVIRONMENTAL CONSULTANCY LTD

Project name: CYBO

Project type (institutional, national, international): national

Coordinating body: OC-UCY

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. YIANNA SAMUEL RHOADS

B. GIORGOS FYTTIS

C. GREGORY KONNARIS

D. MARIOS NIKOLAIDES

E. DAN HAYES

F. GEORGE ZODIATIS (to be conducted for further information about data)

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI See top of page.	APPROXIMATE POSITION LATITUDE deg	min	N/S	LONGITUDE deg	min	E/W	DATA TYPE enter Roscop code(s) from the list on next pages	DESCRIPTION Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
A, B, C	34	38.00	N	33	03.43	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	37.50	N	33	03.43	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	37.00	N	33	03.43	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	36.50	N	33	03.43	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	36.00	N	33	03.43	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	36.00	N	33	02.63	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	36.50	N	33	02.63	E	H10, B09	CTD cast from 0 to100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	37.00	N	33	02.63	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	37.50	N	33	02.63	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
A, B, C	34	38.00	N	33	02.63	E	H10, B09	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density Zooplankton abundance and size measurements1 net haul at the 0-100 m depth layer using 2 connected nets of 45 µm and 200 µm mesh size. (Calvet type; both 25 cm mouth diameter).
D	34	57.24	N	33	41.88	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	55.42	N	33	53.62	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	56.41	N	33	58.88	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	55.14	N	34	05.07	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	47.16	N	33	34.42	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	46.32	N	33	33.68	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	45.17	N	33	29.82	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	43.47	N	33	27.31	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	41.66	N	33	07.92	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	41.48	N	33	11.11	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	40.56	N	33	08.36	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	33.19	N	32	57.83	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	35.08	N	32	52.22	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	34.97	N	32	45.41	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	35.30	N	32	49.00	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	35.05	N	33	10.29	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	36.24	N	33	14.89	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	35.46	N	33	12.65	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	36.16	N	33	18.85	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	35.22	N	32	50.83	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	38.18	N	32	27.22	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	36.18	N	32	35.17	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	35	04.35	N	32	21.37	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	35	05.22	N	32	27.46	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	35	06.21	N	32	28.85	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	35	04.53	N	34	02.28	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).
D	34	38.02	N	33	29.17	E	H10	CTD cast from 0 to 100 m (pressure, temperature, conductivity, depth, salinity, density).

E,F	34	30.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	34	25.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	34	15.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	34	00.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	33	45.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	33	30.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	33	15.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).
E,F	33	00.00	N	33	00.00	E	H10	CTD cast from 0 to 1000 m (pressure, temperature, conductivity, depth, salinity, density, dissolved oxygen).

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Levantine Basin

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Levantine Basin
Mardsen square 141;1

The Levantine Basin is the largest and deepest as a whole basin in the Mediterranean Sea. The hydrological structure in the Levantine Basin is dominated by cyclonic and anticyclonic eddies, meandering jets, intermediate water formation, upwelling phenomena, etc.

IEO questionnaire on planned cruises

PERSEUS WP3
R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises:

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

03/2012
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

06/2015
month/ year

Frequency (monthly, seasonal etc)
seasonal

Duration of each cruise (number of days approximately)
20 days

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: INSTITUTO ESPAÑOL DE OCEANOGRAFIA – CENTRO OCEANOGRAFICO DE BALEARES (IEO-COB)

Address: Muelle de Poniente s/n. 07015. Palma de Mallorca. Islas Baleares

Country: Spain

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

Name: José Luis López-Jurado

email: lopez.jurado@ba.ieo.es

Laboratory: INSTITUTO ESPAÑOL DE OCEANOGRAFIA – CENTRO OCEANOGRAFICO DE BALEARES (IEO-COB)

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

M. Carmen Garcia-Martinez, INSTITUTO ESPAÑOL DE OCEANOGRAFIA – CENTRO OCEANOGRAFICO DE MALAGA (IEO-COB)

Mariano Serra Tur, INSTITUTO ESPAÑOL DE OCEANOGRAFIA – CENTRO OCEANOGRAFICO DE BALEARES (IEO-COB)

José Luis López-Jurado, INSTITUTO ESPAÑOL DE OCEANOGRAFIA – CENTRO OCEANOGRAFICO DE BALEARES (IEO-COB)

1

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The main objective of these cruises is defined as the "space-time monitoring of physical variables, chemical, biological meaningful and distribution of phytoplankton and zooplankton communities in profiles located at special points along the Spanish Mediterranean coast ". For their achievement should be made four oceanographic on a quarterly basis, covering transects perpendicular to the coast at special points in the Spanish Mediterranean.

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: RADMED-DOS

Project type (institutional, national, international): institutional

Coordinating body: INSTITUTO ESPAÑOL DE OCEANOGRAFIA

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. J.L. López-Jurado

B. Rosa Balbín

C. M. Carmen García-Martinez

D. Francina Moya

E. Alberto Aparicio

F. Manuel Vargas-Yañez

G. M.Luz Fernandez de Puelles

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'. This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI	APPROXIMATE POSITION LATITUDE			LONGITUDE			DATA TYPE	DESCRIPTION
See top of page.	deg	min	N/S	deg	min	E/W	enter Roscop code(s) from the list on next pages	Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
A, B							H09	Niskin bottle
A, B							H10	CTD cast
E, B							H21	Dissolved Oxygen
E							H22	Phosphate
E							H24	Nitrate
E							H25	Nitrite
E							H26	Silicate
C, D							H27	Alcalinity
C, D							H74	Carbon dioxide
E							B02	Phytoplankton
G							B09	Zooplankton

2

Station	long. W (degree)	long. W (min.)	Latitude N (degree)	Latitude N (min.)	Depth (m)	Roscop Code(s)
P1	-4	-44.3580	36	28.2000	30	H09, H10, H22, H24, H25, H26
P2	-4	-44.4960	36	25.4280	130	H09, H10, H22, H24, H25, H26, B02,B09
P3	-4	-44.5320	36	21.0960	500	H09, H10, H22, H24, H25, H26
P4	-4	-44.4960	36	15.0000	800	H09, H10, H22, H24, H25, H26, B02, B09
M1	-4	-24.3480	36	41.7600	25	H09, H10, H22, H24, H25, H26
M2	-4	-21.2160	36	38.3160	75	H09, H10, H22, H24, H25, H26, B02,B09
M3	-4	-18.6180	36	35.5980	200	H09, H10, H22, H24, H25, H26
M4	-4	-15.8280	36	32.5380	350	H09, H10, H22, H24, H25, H26, B02, B09
M5	-4	-13.1220	36	29.4900	510	H09, H10, H22, H24, H25, H26
V1	-4	-3.9900	36	44.1180	25	H09, H10, H22, H24, H25, H26
V2	-4	-3.8460	36	41.2500	75	H09, H10, H22, H24, H25, H26, B02,B09
V3	-4	-3.9000	36	38.2800	300	H09, H10, H22, H24, H25, H26
V4	-4	-3.9000	36	34.2000	490	H09, H10, H22, H24, H25, H26, B02, B09
S1	-3	-28.092	36	40.746	200	H09, H10, H22, H24, H25, H26
S2	-3	-28.092	36	39.348	300	H09, H10, H22, H24, H25, H26, B02,B09
S3	-3	-28.092	36	37.422	500	H09, H10, H22, H24, H25, H26
S4	-3	-28.092	36	34.614	700	H09, H10, H22, H24, H25, H26, B02, B09
S5	-3	-28.092	36	31.722	800	H09, H10, H22, H24, H25, H26
CG1	-2	-9.912	36	42.180	50	H09, H10, H22, H24, H25, H26
CG2	-2	-9.912	36	40.650	75	H09, H10, H22, H24, H25, H26, B02,B09
CG3	-2	-9.912	36	37.152	100	H09, H10, H22, H24, H25, H26
CG4	-2	-9.912	36	29.826	700	H09, H10, H22, H24, H25, H26, B02, B09
CG5	-2	-9.912	36	25.332	1200	H09, H10, H22, H24, H25, H26
CP1	0	-45.45	37	33.012	50	H09, H10, H22, H24, H25, H26
CP2	0	-45.45	37	29.790	100	H09, H10, H22, H24, H25, H26, B02,B09
CP3	0	-45.45	37	27.366	600	H09, H10, H22, H24, H25, H26
CP4	0	-45.45	37	22.368	2100	H09, H10, H22, H24, H25, H26, B02, B09

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Western Mediterranean, Alboran Sea, Algerian Basin, Balearic Sea

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Balearic Sea: 180;3
Algerian Basin: 144;1
Alboran Sea: 109;1
Alboran Sea: 109;2

Station	long. E (degree)	long. E (min.)	Latitude N (degree)	Latitude N (min.)	Depth (m)	Roscop Code(s)
1	2	24.000	39	30.000	78	H10
2	2	19.002	39	27.198	98	H09, H10, H22, H24, H25, H26
3	2	13.998	39	24.798	117	H10
4	2	09.000	39	22.002	131	H09, H10, H22, H24, H25, H26
5	2	04.002	39	19.398	479	H10
6	1	58.800	39	16.602	629	H09, H10, H22, H24, H25, H26
7	1	53.598	39	13.800	638	H10
8	1	48.498	39	11.202	530	H09, H10, H22, H24, H25, H26
9	1	43.200	39	08.202	290	H10
10	1	37.902	39	05.400	78	H09, H10, H22, H24, H25, H26
11	1	10.200	38	52.200	106	H10
12	1	04.002	38	52.200	129	H09, H10, H22, H24, H25, H26
13	0	58.800	38	52.200	450	H10
14	0	52.200	38	52.200	677	H09, H10, H22, H24, H25, H26
15	0	45.402	38	52.200	840	H10
16	0	39.402	38	52.200	764	H09, H10, H22, H24, H25, H26
17	0	33.300	38	52.200	670	H10
18	0	27.000	38	52.200	315	H09, H10, H22, H24, H25, H26, B02,B09
19	0	20.598	38	52.200	130	H10
20	0	14.598	38	52.200	96	H09, H10, H22, H24, H25, H26, B02, B09
21	0	08.802	38	52.200	30	H10
22	0	16.200	38	56.700	123	H10
23	0	23.802	39	01.398	500	H10
24	0	31.500	39	06.000	1070	H10
25	0	39.102	39	10.698	1260	H10
26	0	48.402	39	07.998	1120	H10
27	0	57.498	39	05.202	817	H10
28	1	06.498	39	02.400	285	H10
29	1	12.198	39	00.500	110	H10
30	1	32.802	39	08.202	89	H10
31	1	36.498	39	15.000	525	H10
32	1	40.200	39	21.798	915	H10
33	1	43.998	39	28.602	1373	H10
34	1	53.802	39	29.502	1231	H10
35	2	03.402	39	30.000	557	H10
36	2	13.002	39	30.798	108	H10
37	2	19.698	39	31.200	89	H10
B1	2	25.630	39	28.602	75	H09, H10, H22, H24, H25, H26, B02,B09
B2	2	25.602	39	24.430	100	H09, H10, H22, H24, H25, H26, B02,B09
B3	2	25.900	39	20.300	200	H09, H10, H22, H24, H25, H26, B02, B09
317	3	10.260	39	00.000	2315	H10
MH1	4	21.498	39	52.002	75	H09, H10, H22, H24, H25, H26
MH2	4	25.002	39	57.000	295	H09, H10, H22, H24, H25, H26, B02,B09
MH3	4	30.000	40	03.498	1765	H09, H10, H22, H24, H25, H26
MH4	4	34.962	40	10.002	2400	H09, H10, H22, H24, H25, H26, B02, B09
T1	0	52.248	40	30.198	50	H09, H10, H22, H24, H25, H26
T2	1	03.882	40	28.770	80	H09, H10, H22, H24, H25, H26, B02,B09
T3	1	15.828	40	27.390	100	H09, H10, H22, H24, H25, H26
T4	1	36.000	40	25.902	940	H09, H10, H22, H24, H25, H26, B02, B09
BNA1	2	12.600	41	19.242	75	H09, H10, H22, H24, H25, H26
BNA2	2	18.132	41	15.000	295	H09, H10, H22, H24, H25, H26, B02,B09
BNA3	2	24.648	41	10.000	707	H09, H10, H22, H24, H25, H26
BNA4	2	31.170	41	04.998	1320	H09, H10, H22, H24, H25, H26, B02, B09
BNA5	2	37.680	41	00.000	1670	H09, H10, H22, H24, H25, H26

CNRS questionnaire on planned cruises

PERSEUS WP3

R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises: 37

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

01/2012
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

12/2015
month/ year

Frequency (monthly, seasonal etc) MONTHLY for MOOSE-DYF (off Villefranche s/Mer), MOOSE-ANT (off-Toulon) and MOOSE-MOL (off Banyuls s/Mer), ANNUAL for MOOSE-GE. The program MOOSE-GE could evolve toward a seasonal (automn/spring) survey, but this is not decided yet.

Duration of each cruise (number of days approximately) 1 day for the monthly cruises, 18 days for MOOSE-GE

RESPONSIBLE LABORATORY enter name and address of the laboratory responsible for coordinating the scientific planning of the cruises

Name: MIO (Mediterranean Institute Of Oceanography)

Address: Campus De Luminy, Case 901, 13288 MARSEILLE Cedex 09

Country: FRANCE

RESPONSIBLE COORDINATING SCIENTIST enter name, email and laboratory of the person in charge of coordinating all the cruises

Name: Patrick Raimbault

email: Patrick.Raimbault@Univmed.Fr

Laboratory: MIO

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

Pierre TESTOR, LOCEAN, for MOOSE-GE cruises
Laurent COPPOLA, LOV, for MOOSE-DYF cruises
Dominique LEFEVRE, MIO, for MOOSE-ANT cruises
Ian SALTER, LOMIC, for MOOSE-MOL cruises

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The main objective of the "Mediterranean Ocean Observing System on Environment" (MOOSE) is to observe the long-term evolution of the NW Mediterranean Sea in the context of the climate change and anthropogenic pressure (over > 10 yrs) in order to be able to detect and identify long-term environmental trend and anomalies of the marine ecosystem. In this context, MOOSE aims to build an integrated and multi-disciplinary observing system in the NW Mediterranean Sea in relation to scientific issues raised in the context of the "Mediterranean Integrated STudies at Regional And Local Scales" (MISTRALS) international program.

Integrated and multi-scale observation networks must include both high frequency monitoring and near real-time measurements capabilities in order to precisely document the broad spectrum of temporal and spatial scales involved and to rely it on the main circulation features already identified (basin scale gyres, eddies, biogeochemical provinces). Measurements at high vertical and temporal resolutions can be performed by eulerian observatories but the deployments of an array of stations lessen their impact due to the poor spatial resolution possible. Synergies with other components (ships, floats, gliders) are prerequisites for the establishment of such an ocean observing system for maximizing data coverage in space and time and with respect to the observed flow and processes. Presently, MOOSE is combining eulerian observatories, autonomous mobile platforms (profilers, gliders) and research vessels.

The eulerian observation is organized in four mooring sites in which a ship survey - which are the subject of this report - is performed on a regular basis, either monthly or annually :

- LION (hydrodynamic sensors and sediment traps) in the convective zone of Gulf of Lion (since 2007, CEFREM, LOCEAN, Hydrochanges CIESM). The annual ship survey of this site is referred to as MOOSE-GE.
- DYFAMED, in the Ligurian Sea (sediment traps and hydrodynamic sensors) for atmospheric and marine flux transfer to the surface and deep waters (since 1988, OOV, Eurosites). The monthly ship survey of this site is referred to as MOOSE-DYF.
- ANTARES in the north western current offshore from Toulon (hydrodynamic sensors near the bottom) for hydrodynamic and organic matter remineralization in deep water (since 2004, MIO, Eurosites). The monthly ship survey of this site is referred to as MOOSE-ANT.
- MOLA in the western part of the Gulf of Lions off the marine station in Banyuls, devoted to the bacterial diversity in relation to the variability of the hydrology (since 2003, OOB). The monthly ship survey of this site is referred to as MOOSE-MOL.

In addition to the survey of the LION site, the annual MOOSE-GE campaign performs deep CTDs transects which allows to map the circulation in the North Gyre(Northern Current, western Corsica current, North Balearic front and key convection areas in the middle of the North Gyre).

PROJECT (IF APPLICABLE) if the cruises are designated as part of another project (or expedition) other than PERSEUS, then enter the name of the project, and of organisation responsible for co-ordinating the project.

Project name: MOOSE (Mediterranean Ocean Observing System on Environment)

Project type (institutional, national, international): National

Coordinating body: INSU/CNRS

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. Patrick RAIMBAULT, Institut Méditerranéen d'Océanologie - campus de Luminy , 162 Av. de Luminy, 13288 MARSEILLE CEDEX09

B. Dominique LEFEVRE, Institut Méditerranéen d'Océanologie - campus de Luminy , 162 Av. de Luminy, 13288 MARSEILLE CEDEX09

C. Pierre TESTOR, Laboratoire d'océanographie et du climat : expérimentations et approches numériques, Tour 15-14, 2e étage 4, place Jussieu 75252 PARIS CEDEX05

D. Laurent COPPOLA, Laboratoire d'Oceanographie de Villefranche, Observatoire Océanologique, 181, chemin du Lazaret, BP 28 6230 VILLEFRANCHE SUR MER CEDEX4

E. Ian SALTER, Laboratoire Arago - Avenue du Fontaulé - 66650 BANYULS SUR MER

F. ………

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises. Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI See top of page.	APPROXIMATE POSITION LATITUDE deg	LATITUDE min	LATITUDE N/S	LONGITUDE deg	LONGITUDE min	LONGITUDE E/W	DATA TYPE enter Roscop code(s) from the list on next pages	DESCRIPTION Identify, as appropriate, the nature of the instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
D	43	24	N	7	53	E	H10	Station DYFAMED. CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence, light transmission)
D	43	24	N	7	53	E	H09	Station DYFAMED. Niskin bottle (see full description of sampling below)
B	42	48	N	6	10	E	H10	Station ANTARES. CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence, light transmission)
B	42	48	N	6	10	E	H09	Station ANTARES. Niskin bottle (see full description of sampling below)
C	42	04	N	4	39	E	H10	Station LION. CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence, light transmission)
C	42	04	N	4	39	E	H09	Station LION. Niskin bottle (see full description of sampling below)
E	42	27	N	3	33	E	H10	Station MOLA. CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence, light transmission)
E	42	27	N	3	33	E	H09	Station MOLA. Niskin bottle (see full description of sampling below)

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

28A. Med. Sea - Western Basin

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Northwestern Mediterranean Sea

Marsden square : **180;1 and 180;2**

The area covered by the MOOSE cruises is the so called "Northern Gyre" which encompass the Ligurian Sea to the East, Gulf of Lions and the Provencal Basin in the centre and the Balearic Sea to the West. In addition to the stations listed above in the eulerian sites, ~ 80 hydrographic stations with CTD and water sampling (nutrients, dissolved inorganic carbon, chlorophyll and pigments) are performed in the Northern Gyre.

CNR ISMAR questionnaire on planned cruises

PERSEUS WP3
R/V PRE-CRUISE PLANNING SUMMARY REPORT

CRUISES FREQUENCY, DURATION

Total number of cruises: 1

Starting date (first day of first cruise). For an existing ongoing program please indicate the first cruise that will be included into the PERSEUS activities

04/2014
month/ year

Ending date (first day of last cruise). For an existing ongoing program please indicate the last cruise that will be included into the PERSEUS activities

05/2014
month/ year

Frequency (monthly, seasonal etc)
once

Duration of each cruise (number of days approximately)
25

RESPONSIBLE LABORATORY

Name: CNR ISMAR U.O.S. Pozzuolo di Lerici
Address: Forte S.Teresa Pozzuolo di Lerici 19036 La Spezia
Country: ITALY

RESPONSIBLE COORDINATING SCIENTIST

Name: KATRIN SCHROEDER
email: katrin.schroeder@ismar.cnr.it
Laboratory: CNR ISMAR Venezia

CHIEF SCIENTIST(S) If already known enter name and laboratory of the person(s) in charge of the scientific work (chief of mission) during the cruises.

MIRENO BORGHINI
mireno.borghini@sp.ismar.cnr.it
CNR ISMAR La Spezia

OBJECTIVES AND BRIEF NARRATIVE OF CRUISE enter sufficient information about the purpose and nature of the cruise so as to provide the context in which the report data were collected.

The objective is to continue the MEDOCC series, western basin-scale surveys through hydrographic multidisciplinary sections, closing sub-volumes of the basin, following a box-model approach to allow budget computations of mass, salt, heat and biogeochemical properties. The Ligurian section crosses the DYFAMED position. The Corsica and Sicily sections correspond to the CORSICA, C01 and C02 moorings, respectively. This survey has already been carried out in 2005, 2006, 2007 and 2008. During PERSEUS it will be effected one time and coordinated with the annual MOOSE cruise.

PROJECT (IF APPLICABLE)
Project name: nn

Project type (institutional, national, international): institutional

Coordinating body: nn

PRINCIPAL INVESTIGATORS: Enter the name and address of the Principal Investigators responsible for the data to be collected on the cruises and who may be contacted for further information about the data. (The letter assigned below, against each Principal Investigator is used, on the following table under the column heading 'PI', to identify the data sets for which he/she is responsible)

A. KATRIN SCHROEDER

B. MIRENO BORGHINI

C. STEFANIA SPARNOCCHIA

D. ANNA VETRANO

E. ANNALISA GRIFFA

F. CAROLINA CANTONI

G. MARINA AMPOLO RELLA

TIME SERIES DATA, MOORINGS, BOTTOM MOUNTED GEAR AND DRIFTING SYSTEMS

This section should be used to report data to be collected at fixed locations which are returned to routinely in order to construct 'time series'.
This section may also be used for reporting moorings, bottom mounted gear and drifting systems (both surface and deep) to be deployed and/or recovered during the cruises.
Separate entries should be made for each location/station (only deployment positions need be given for drifting systems).

PI	APPROXIMATE POSITION						DATA TYPE	DESCRIPTION
See top of page.	LATITUDE			LONGITUDE			enter Roscop code(s) from the list on next pages	Identify, as appropriate, the nature of the Instrumentation the parameters (to be) measured, the number of instruments and their depths, whether deployed and/or recovered, estimated duration of deployments, and any identifiers given to the site (e.g. station name, code).
	deg	min	N/S	deg	min	E/W		
A,B	1	55,8	N	41	12	E	H09, H10, H21	Station b1, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	4,14	N	41	0,6	E	H09, H10, H21	Station b02 , CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	12,12	N	40	49,2	E	H09, H10, H21	Station b03, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	21,18	N	40	36	E	H09, H10, H21	Station b04, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	29,58	N	40	24	E	H09, H10, H21	Station b05, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	38,4	N	40	12	E	H09, H10, H21	Station b06, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	46,14	N	40	0	E	H09, H10, H21	Station b07, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	2	49,86	N	39	54,6	E	H09, H10, H21	Station b08, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0	N	39	12	E	H09, H10, H21	Station d1, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,12	N	39	0	E	H09, H10, H21	Station d2, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,24	N	38	48,6	E	H09, H10, H21	Station d3, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,24	N	38	24	E	H09, H10, H21	Station d5, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,24	N	38	0	E	H09, H10, H21	Station d7, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,24	N	37	48	E	H09, H10, H21	Station d8, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,24	N	37	24	E	H09, H10, H21	Station d10, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	0,42	N	37	1,2	E	H09, H10, H21	Station d12, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	47,94	N	38	47,4	E	H09, H10, H21	Station d13, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	48	N	38	35,4	E	H09, H10, H21	Station d14, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	48	N	38	23,4	E	H09, H10, H21	Station d15, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	48	N	38	11,4	E	H09, H10, H21	Station d16, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	48	N	38	0,6	E	H09, H10, H21	Station d17, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	48	N	37	48	E	H09, H10, H21	Station d18, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	47,94	N	37	36	E	H09, H10, H21	Station d19, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	24,18	N	39	48	E	H09, H10, H21	Station s1, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	35,1	N	39	49,2	E	H09, H10, H21	Station s2, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	59,76	N	39	48	E	H09, H10, H21	Station s4, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	24,24	N	39	48	E	H09, H10, H21	Station s6, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	48,84	N	39	48	E	H09, H10, H21	Station s8, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	6	12,12	N	39	48	E	H09, H10, H21	Station s10, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	6	36,66	N	39	48	E	H09, H10, H21	Station s12, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	6	59,88	N	39	48	E	H09, H10, H21	Station s14, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	23,82	N	39	48	E	H09, H10, H21	Station s16, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	48,96	N	39	48	E	H09, H10, H21	Station s18, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	59,88	N	39	48	E	H09, H10, H21	Station s19, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	12,24	N	39	48	E	H09, H10, H21	Station s20, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	4,56	N	39	48	E	H09, H10, H21	Station s22, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	32,34	N	39	49,2	E	H09, H10, H21	Station s23, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	48,06	N	42	53,4	E	H09, H10, H21	Station l2, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	36,6	N	42	48,6	E	H09, H10, H21	Station l3, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	24,3	N	42	45	E	H09, H10, H21	Station l4, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	5	11,4	N	42	40,8	E	H09, H10, H21	Station l5, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	59,7	N	42	35,4	E	H09, H10, H21	Station l6, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	48,18	N	42	31,2	E	H09, H10, H21	Station l7, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	35,28	N	42	27	E	H09, H10, H21	Station l8, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	24,18	N	42	22,8	E	H09, H10, H21	Station l9, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	12	N	42	17,4	E	H09, H10, H21	Station l10, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	4	1,08	N	42	15	E	H09, H10, H21	Station l11, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	47,4	N	42	8,4	E	H09, H10, H21	Station l12, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	34,98	N	42	4,2	E	H09, H10, H21	Station l13, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	3	22,92	N	42	0	E	H09, H10, H21	Station l14, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	39,48	N	43	45	E	H09, H10, H21	Station 900, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	42,96	N	43	41,4	E	H09, H10, H21	Station 901, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	46,98	N	43	37,2	E	H09, H10, H21	Station 902, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	50,1	N	43	33,6	E	H09, H10, H21	Station 903, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	54,06	N	43	29,4	E	H09, H10, H21	Station 904, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	7	57,84	N	43	25,2	E	H09, H10, H21	Station 905, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)

A,B	8	6	N	43	17,4	E	H09, H10, H21	Station 906, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	13,98	N	43	9	E	H09, H10, H21	Station 907, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	21,96	N	43	1,2	E	H09, H10, H21	Station 908, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	30	N	42	51,6	E	H09, H10, H21	Station 909, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	34,02	N	42	48	E	H09, H10, H21	Station 910, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	37,98	N	42	43,2	E	H09, H10, H21	Station 911, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	40,86	N	42	40,2	E	H09, H10, H21	Station 912, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	8	43,5	N	42	37,2	E	H09, H10, H21	Station 913, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	26,16	N	43	1,8	E	H09, H10, H21	Station 100, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	20,28	N	43	1,8	E	H09, H10, H21	Station 101, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	16,14	N	43	1,8	E	H09, H10, H21	Station 102, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	11,4	N	43	2,4	E	H09, H10, H21	Station 103, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	5,64	N	43	1,8	E	H09, H10, H21	Station 104, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	58,86	N	43	2,4	E	H09, H10, H21	Station 105, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	52,92	N	43	1,8	E	H09, H10, H21	Station 106, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	46,14	N	43	1,8	E	H09, H10, H21	Station 107, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	41,94	N	43	1,8	E	H09, H10, H21	Station 108, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	38,52	N	43	1,8	E	H09, H10, H21	Station 109, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	36,06	N	43	1,8	E	H09, H10, H21	Station 110, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	31,86	N	43	1,2	E	H09, H10, H21	Station 111, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	47,22	N	39	0,6	E	H09, H10, H21	Station 291, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	9	52,2	N	38	58,2	E	H09, H10, H21	Station 281, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	0,9	N	38	54,6	E	H09, H10, H21	Station 261, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	10,98	N	38	51,6	E	H09, H10, H21	Station 241, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	15,48	N	38	48,6	E	H09, H10, H21	Station 231, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	29,64	N	38	43,2	E	H09, H10, H21	Station 229, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	41,04	N	38	37,8	E	H09, H10, H21	Station 227, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	10	52,14	N	38	31,8	E	H09, H10, H21	Station 225, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	4,68	N	38	28,2	E	H09, H10, H21	Station 223, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	14,76	N	38	22,8	E	H09, H10, H21	Station 221, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	20,34	N	38	20,4	E	H09, H10, H21	Station 220, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	25,38	N	38	18,6	E	H09, H10, H21	Station 219, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	31,86	N	38	13,8	E	H09, H10, H21	Station 218, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	40,02	N	38	10,8	E	H09, H10, H21	Station 217, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	43,02	N	38	9	E	H09, H10, H21	Station 216, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	45,96	N	38	9	E	H09, H10, H21	Station 215, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	50,76	N	38	7,2	E	H09, H10, H21	Station 214, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	57,42	N	38	5,4	E	H09, H10, H21	Station 213, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	12	5,88	N	38	3	E	H09, H10, H21	Station 212, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	18,24	N	37	10,8	E	H09, H10, H21	Station 410, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	23,76	N	37	13,8	E	H09, H10, H21	Station 436, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	25,98	N	37	13,8	E	H09, H10, H21	Station 437, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	29,16	N	37	16,8	E	H09, H10, H21	Station 460, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	33,78	N	37	18,6	E	H09, H10, H21	Station 462, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	35,88	N	37	20,4	E	H09, H10, H21	Station 451, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	39,72	N	37	22,2	E	H09, H10, H21	Station 463, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	44,58	N	37	25,2	E	H09, H10, H21	Station 434, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	49,68	N	37	27,6	E	H09, H10, H21	Station 438, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	11	55,44	N	37	30,6	E	H09, H10, H21	Station 433, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	12	0,36	N	37	35,4	E	H09, H10, H21	Station 406, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)
A,B	12	8,64	N	37	39	E	H09, H10, H21	Station 405, CTD cast from 0 to bottom (pressure, temperature, conductivity, oxygen, fluorescence)

GENERAL OCEAN AREA(S): Enter the names of the oceans and/or seas in which data will be collected during the cruises – please use commonly recognised names (see, for example, International Hydrographic Bureau Special Publication No. 23, 'Limits of Oceans and Seas').

Western Mediterranean Sea

SPECIFIC AREAS: Enter a description of the area(s). Such descriptions may include references to local geographic areas, to sea floor features, or to geographic coordinates.
Please insert here the number of each 5 degree square in which data were collected from the marsden square list provided at the end of the document

Ligurian-Provencal Basin, Gulf of Lion, Balearic Sea, Algerian Basin, Central Mediterranean,Sardinian Channel, Sicily Channel, Corsica Channel
Mardsen square 142;1

The Ligurian–Provencal Basin, along with the Gulf of Lion and the Balearic Sea, forms the North-western Mediterranean Basin. This region is characterized by a general cyclonic circulation involving both the surface layer of Atlantic Water (AW) and the Levantine Intermediate Water (LIW) layer below. In winter, these basins are sites of important dense water formation processes capable of triggering convective flows within the water column (Gasparini et al., 1999). The processes are particularly intense in the Gulf of Lions (MEDOC Group, 1970; Leaman and Schott, 1991), even though they have also been reported in the Balearic Sea (Salat and Font, 1987) as well as in the central part of the Ligurian Basin (Sparnocchia et al., 1995).
The Gulf of Lions is mainly characterised by a permanent cyclonic circulation and manifests strong seasonal variations of the physical and biochemical properties due to convective movements and deep mixing during the wintertime (Millot, 1999). In winter, the deep convection sets the homogenisation of the water column bringing saline water from the intermediate layer close to the surface. In the Gulf of Lions, the highest surface phytoplankton biomass develops in winter and spring due to the violent mixing and vertical injections of nutrient rich deep waters in the open-sea convective region.
In the Algerian Basin the AW flow forms what is now commonly named the "Algerian Current" (Millot, 1985). This current is relatively narrow (30–50 km) and deep (200–400 m at the coast) near 0°E, but it becomes wider and thinner while progressing eastward (Benzohra and Millot, 1995). Its unstable character sometimes leads to the generation of meanders a few tens of km in wavelength, but the current continues flowing along the Algerian slope till the Channel of Sardinia (Morel and Andre, 1991). The mesoscale eddies in the Algerian Basin induce intense currents over the whole deeper layer and even close to the bottom (Millot et al., 1997).
The Central Mediterranean is characterised by a very complicated bottom topography, which directly affects the water exchange between the two Mediterranean basins (western and eastern Mediterranean Sea). The most salient features are the unequal depths of the boundary sections (Astraldi et al., 2002). In the Sardinian Channel, the sill depth is at about 1900 m, allowing the free exchange of the deep waters with the WMED, but in the Sicily Channel, the deeper sill is at about 430 m, thus imposing strong constraints on the exchanges with the EMED. In between, a wide area of very shallow waters off Tunisia provides a further obstacle to a direct connection between the two basins. All water masses outflowing at depth, both from the WMED (Krivosheya and Ovchinnikov, 1973; Hopkins, 1988) and from the EMED (Astraldi et al., 1996), are conveyed into the Tyrrhenian Sea, an intermediate basin whose southern part strongly interacts with the central Mediterranean. The section between Sicily and Sardinia is substantially formed by two main channels with a wide plateau in between. The deeper one, in the central part, directly connects the Tyrrhenian Sea with the Sardinian Channel and the WMED, and the other, adjacent to the Sicilian slope, connects, with an increasing depth, the Sicily Strait with the Tyrrhenian Sea.
Hence, this study area is a very complex system, with even extreme climatic conditions in its northern part and an almost sub-tropical climate in its southern part. It sustains one of the most productive areas of the whole Mediterranean Sea, with the vastest marine mammals and large fishes community.

APPENDIX 2: ROSCOP PARAMETER CODES USED IN THE ICES-ROSCOP SYSTEM

ROSCOP Parameter Codes Used in the ICES-ROSCOP system

METEOROLOGY *
PHYSICAL OCEANOGRAPHY *
CHEMICAL OCEANOGRAPHY *
MARINE CONTAMINANTS/POLLUTION *
MARINE BIOLOGY/FISHERIES *
MARINE GEOLOGY/GEOPHYSICS *
OTHER (BODC/JGOFS) CODES USED IN ROSCOP *

Roscop Code	Description
	METEOROLOGY
M01	Upper air observations
M02	Incident radiation
M05	Occasional standard measurements
M06	Routine standard measurements
M71	Atmospheric chemistry
M90	Other meteorological measurements
	PHYSICAL OCEANOGRAPHY
H71	Surface measurements underway (T,S) *
H13	Bathythermograph
H09	Water bottle stations
H10	CTD stations
H11	Subsurface measurements underway (T,S) *
H72	Thermistor chain
H16	Transparency (eg transmissometer)
H17	Optics (eg underwater light levels)
H73	Geochemical tracers (eg freons)
D01	Current meters
D71	Current profiler (eg ADCP)
D03	Currents measured from ship drift *
D04	GEK
D05	Surface drifters/drifting buoys
D06	Neutrally buoyant floats
D09	Sea level (incl. bottom pressure & inverted echosounder)
D72	Instrumented wave measurements
D90	Other physical oceanographic measurements
	CHEMICAL OCEANOGRAPHY
H21	Oxygen
H74	Carbon dioxide
H33	Other dissolved gases
H22	Phosphate
H23	Total - P
H24	Nitrate
H25	Nitrite
H75	Total - N
H76	Ammonia
H26	Silicate
H27	Alkalinity
H28	PH
H30	Trace elements
H31	Radioactivity
H32	Isotopes
H90	Other chemical oceanographic measurements
	MARINE CONTAMINANTS/POLLUTION
P01	Suspended matter
P02	Trace metals
P03	Petroleum residues
P04	Chlorinated hydrocarbons
P05	Other dissolved substances
P12	Bottom deposits
P13	Contaminants in organisms
P90	Other contaminant measurements
	MARINE BIOLOGY/FISHERIES
B01	Primary productivity
B02	Phytoplankton pigments (eg chlorophyll, fluorescence)
B71	Particulate organic matter (inc POC, PON)
B06	Dissolved organic matter (inc DOC)
B72	Biochemical measurements (eg lipids, amino acids)
B73	Sediment traps
B08	Phytoplankton
B09	Zooplankton
B03	Seston
B10	Neuston
B11	Nekton
B13	Eggs & larvae
B07	Pelagic bacteria/micro-organisms
B16	Benthic bacteria/micro-organisms
B17	Phytobenthos
B18	Zoobenthos
B25	Birds
B26	Mammals & reptiles
B14	Pelagic fish
B19	Demersal fish
B20	Molluscs
B21	Crustaceans
B28	Acoustic reflection on marine organisms.
B37	Taggings
B64	Gear research
B65	Exploratory fishing
B90	Other biological/fisheries measurements
	MARINE GEOLOGY/GEOPHYSICS
G01	Dredge
G02	Grab
G03	Core - rock
G04	Core - soft bottom
G08	Bottom photography
G71	In-situ seafloor measurement/sampling
G72	Geophysical measurements made at depth
G73	Single-beam echosounding *

G74	Multi-beam echosounding *
G24	Long/short range side scan sonar *
G75	Single channel seismic reflection *
G76	Multichannel seismic reflection *
G26	Seismic refraction *
G27	Gravity measurements
G28	Magnetic measurements
G90	Other geological/geophysical measurements
	OTHER (BODC/JGOFS) CODES USED IN ROSCOP
ATTNZR01	(H16)Red light attenuance (unspecified beam)
IRRDPP01	(H17)Downwelling 2-pi PAR irradiance
NPUPRYP4	(H22)Normalised phosphorous uptake (dark with antibiotic)
NPUPRZP4	(H22)Normalised phosphorous uptake (188 uE/m2/s with antibiotic)
NPUPRBP1	(H22)Normalised phosphorous uptake (188 uE/m2/s)
NPUPRDP1	(H22)Normalised phosphorous uptake (dark)
NPUPRDP4	(H22)Normalised phosphorous uptake (dark)
NPUPRPP1	(H22)Normalised phosphorous uptake (azide control)
NPUPRPP4	(H22)Normalised phosphorous uptake (azide control)
SNPURBPB	(H22)Size-fractionated normalised phosphorus uptake (188 uE/m2/s)
SNPURBPF	(H22)Size-fractionated normalised phosphorus uptake (188 uE/m2/s)
SNPURDPB	(H22)Size-fractionated normalised phosphorus uptake (dark)
SNPURDPF	(H22)Size-fractionated normalised phosphorus uptake (dark)
SNPURPPB	(H22)Size-fractionated normalised phosphorus uptake (azide control)
SNPURPPF	(H22)Size-fractionated normalised phosphorus uptake (azide control)
NPUPRBP4	(H22)Normalised phosphorous uptake (188 uE/m2/s)
NNUPRBP1	(H24)Normalised nitrate uptake (188 uE/m2/s)
ALXXLGD2	(H30)Dissolved aluminium
CDRURBP2	(H30)Cadmium relative uptake rate (188 uE/m2/s)
CDRURDP2	(H30)Cadmium relative uptake rate (dark)
CORURBP2	(H30)Cobalt relative uptake rate (188 uE/m2/s)
CORURDP2	(H30)Cobalt relative uptake rate (dark)
MNRURBP2	(H30)Manganese relative uptake rate (188 uE/m2/s)
MNRURDP2	(H30)Manganese relative uptake rate (dark)
ZNRURBP2	(H30)Zinc relative uptake rate (188 uE/m2/s)
ZNRURDP2	(H30)Zinc relative uptake rate (dark)
3H1HMXTX	(H32)Tritium/hydrogen atomic ratio
D13CMOPC	(H32)Particulate organic carbon 13C enrichment
D18OMXFZ	(H32)Unspecified benthic foramenifera test
IORTAMDP	(H32)Iodine 129 to 127 ratio
SEIRAMDP	(H32)Standard Error of I129/127
HEXCMXXX	(H33)Dissolved helium
DSF6GCDX	(H73)Dissolved sulphur hexafluoride
F113GCTX	(H73)Freon - 113
FR11GCTX	(H73)Freon - 11
FR12GCTX	(H73)Freon - 12
QCMXGCTX	(H73)Tetrachloromethane(CCl4)
TCEAGCD3	(H73)Dissolved Trichloroethane (C2H3Cl3)
NCUPRZP4	(H74)Normalised carbon uptake (188 uE/m2/s with antibiotic)
NCUPRBP1	(H74)Normalised carbon uptake (188 uE/m2/s)
NCUPRBP4	(H74)Normalised carbon uptake (188 uE/m2/s)
PCO2C101	(H74)pCO2
PCO2GC01	(H74)pCO2 by Gas chromatography
PCO2PT01	(H74)pCO2 at potential temperature
PCOTXXXX	(H74)Temperature of pCO2 determination
SNCURBPB	(H74)Size-fractionated normalised carbon uptake (188 uE/m2/s)
SNCURBPF	(H74)Size-fractionated normalised carbon uptake (188 uE/m2/s)
SNCURZPB	(H74)Size-fractionated normalised carbon uptake (188 uE/m2/s with antibiotic)
SNCURZPF	(H74)Size-fractionated normalised carbon uptake (188 uE/m2/s with antibiotic)
TCO2C1TX	(H74)Total dissolved inorganic carbon (TCO2)
TCO2CBTX	(H74)Total dissolved inorganic carbon (TCO2)
NAUPRBP1	(H76)Normalised ammonium uptake (188 uE/m2/s)
NUUPRBP1	(H90)Normalised urea uptake (188 uE/m2/s)
UREAMDTX	(H90)Urea (unfiltered)
ALPHPIP1	(B01)ALPHPIP1 Quantum yield (alpha)
PMAXPIP1	(B01)Photosynthetic maximum (Pmax)
SFPXPIPE	(B01)Size frac. photosynthetic maximum (Pmax)
TCUPROPZ	(B01)Carbon uptake over incubation
SNCURSPB	(B01)Size-fractionated normalised carbon uptake (natural light)
CAROSSP1	(B02)Spectrophotometric carotenoid pigments (SCOR)
CHLBSSP1	(B02)Spectrophotometric chlorophyll-b (SCOR)
CHLCSSP1	(B02)Spectrophotometric chlorophyll-c (SCOR)
CPHLPR01	(B02)In-situ fluorometer chlorophyll
CPHLFLP1	(B02)Fluorometric chlorophyll-a
CPHLSSP1	(B02)Spectrophotometric chlorophyll-a (SCOR)
PHAESPP1	(B02)Spectrophotometric phaeopigments (Lorenzen)(GF/F filter)
PHAESPPZ	(B02)Spectrophotometric phaeopigments (Lorenzen)(Unspec filter)
PHFXFLXX	(B02)Fluorometric phaeopigment flux
CORGCOD1	(B06)Dissolved Organic carbon (GFF Filter)
CORGCOD2	(B06)Dissolved Organic carbon (.4um filter)
NTOTCNP1	(B71)Particulate total nitrogen (PON)(C/N analyser GFF filter)
NTOTCNPZ	(B71)Particulate total nitrogen (PON)(C/N analyser unspecified filter)
CORGCAP1	(B71)Particulate organic carbon (POC)(acidified-C/N analysis GFF filter)
CORGCNPZ	(B71)Particulate organic carbon (POC)(Unacidified C/N analysis unspecified filter)
CORGCNP3	(B71)Particulate organic carbon (POC)(Unacicified C/N analysis GFC filter)
OCFXCZXX	(B71)Particulate organic carbon flux (acidification unspecified)

APPENDIX 3: 5 DEGREE MARSDEN SQUARES (CENTRAL POINT)

5 DEGREE MARSDEN SQUARES (Central Point)

Longitude	Latitude	Marsden
-177.5	-87.5	605;4
-172.5	-87.5	605;3
-167.5	-87.5	604;4
-162.5	-87.5	604;3
-157.5	-87.5	603;4
-152.5	-87.5	603;3
-147.5	-87.5	602;4
-142.5	-87.5	602;3
-137.5	-87.5	601;4
-132.5	-87.5	601;3
-127.5	-87.5	600;4
-122.5	-87.5	600;3
-117.5	-87.5	599;4
-112.5	-87.5	599;3
-107.5	-87.5	598;4
-102.5	-87.5	598;3
-97.5	-87.5	597;4
-92.5	-87.5	597;3
-87.5	-87.5	596;4
-82.5	-87.5	596;3
-77.5	-87.5	595;4
-72.5	-87.5	595;3
-67.5	-87.5	594;4
-62.5	-87.5	594;3
-57.5	-87.5	593;4
-52.5	-87.5	593;3
-47.5	-87.5	592;4
-42.5	-87.5	592;3
-37.5	-87.5	591;4
-32.5	-87.5	591;3
-27.5	-87.5	590;4
-22.5	-87.5	590;3
-17.5	-87.5	589;4
-12.5	-87.5	589;3
-7.5	-87.5	588;4
-2.5	-87.5	588;3

Longitude	Latitude	Marsden
2.5	-87.5	623;3
7.5	-87.5	623;4
12.5	-87.5	622;3
17.5	-87.5	622;4
22.5	-87.5	621;3
27.5	-87.5	621;4
32.5	-87.5	620;3
37.5	-87.5	620;4
42.5	-87.5	619;3
47.5	-87.5	619;4
52.5	-87.5	618;3
57.5	-87.5	618;4
62.5	-87.5	617;3
67.5	-87.5	617;4
72.5	-87.5	616;3
77.5	-87.5	616;4
82.5	-87.5	615;3
87.5	-87.5	615;4
92.5	-87.5	614;3
97.5	-87.5	614;4
102.5	-87.5	613;3
107.5	-87.5	613;4
112.5	-87.5	612;3
117.5	-87.5	612;4
122.5	-87.5	611;3
127.5	-87.5	611;4
132.5	-87.5	610;3
137.5	-87.5	610;4
142.5	-87.5	609;3
147.5	-87.5	609;4
152.5	-87.5	608;3
157.5	-87.5	608;4
162.5	-87.5	607;3
167.5	-87.5	607;4
172.5	-87.5	606;3
-177.5	-82.5	605;2
-172.5	-82.5	605;1

Longitude	Latitude	Marsden
-167.5	-82.5	604;2
-162.5	-82.5	604;1
-157.5	-82.5	603;2
-152.5	-82.5	603;1
-147.5	-82.5	602;2
-142.5	-82.5	602;1
-137.5	-82.5	601;2
-132.5	-82.5	601;1
-127.5	-82.5	600;2
-122.5	-82.5	600;1
-117.5	-82.5	599;2
-112.5	-82.5	599;1
-107.5	-82.5	598;2
-102.5	-82.5	598;1
-97.5	-82.5	597;2
-92.5	-82.5	597;1
-87.5	-82.5	596;2
-82.5	-82.5	596;1
-77.5	-82.5	595;2
-72.5	-82.5	595;1
-67.5	-82.5	594;2
-62.5	-82.5	594;1
-57.5	-82.5	593;2
-52.5	-82.5	593;1
-47.5	-82.5	592;2
-42.5	-82.5	592;1
-37.5	-82.5	591;2
-32.5	-82.5	591;1
-27.5	-82.5	590;2
-22.5	-82.5	590;1
-17.5	-82.5	589;2
-12.5	-82.5	589;1
-7.5	-82.5	588;2
-2.5	-82.5	588;1
2.5	-82.5	623;1
7.5	-82.5	623;2
12.5	-82.5	622;1

Longitude	Latitude	Marsden
17.5	-82.5	622;2
22.5	-82.5	621;1
27.5	-82.5	621;2
32.5	-82.5	620;1
37.5	-82.5	620;2
42.5	-82.5	619;1
47.5	-82.5	619;2
52.5	-82.5	618;1
57.5	-82.5	618;2
62.5	-82.5	617;1
67.5	-82.5	617;2
72.5	-82.5	616;1
77.5	-82.5	616;2
82.5	-82.5	615;1
87.5	-82.5	615;2
92.5	-82.5	614;1
97.5	-82.5	614;2
102.5	-82.5	613;1
107.5	-82.5	613;2
112.5	-82.5	612;1
117.5	-82.5	612;2
122.5	-82.5	611;1
127.5	-82.5	611;2
132.5	-82.5	610;1
137.5	-82.5	610;2
142.5	-82.5	609;1
147.5	-82.5	609;2
152.5	-82.5	608;1
157.5	-82.5	608;2
162.5	-82.5	607;1
167.5	-82.5	607;2
172.5	-82.5	606;1
-177.5	-77.5	569;4
-172.5	-77.5	569;3
-167.5	-77.5	568;4
-162.5	-77.5	568;3
-157.5	-77.5	567;4

Longitude	Latitude	Marsden
-152.5	-77.5	567;3
-147.5	-77.5	566;4
-142.5	-77.5	566;3
-137.5	-77.5	565;4
-132.5	-77.5	565;3
-127.5	-77.5	564;4
-122.5	-77.5	564;3
-117.5	-77.5	563;4
-112.5	-77.5	563;3
-107.5	-77.5	562;4
-102.5	-77.5	562;3
-97.5	-77.5	561;4
-92.5	-77.5	561;3
-87.5	-77.5	560;4
-82.5	-77.5	560;3
-77.5	-77.5	559;4
-72.5	-77.5	559;3
-67.5	-77.5	558;4
-62.5	-77.5	558;3
-57.5	-77.5	557;4
-52.5	-77.5	557;3
-47.5	-77.5	556;4
-42.5	-77.5	556;3
-37.5	-77.5	555;4
-32.5	-77.5	555;3
-27.5	-77.5	554;4
-22.5	-77.5	554;3
-17.5	-77.5	553;4
-12.5	-77.5	553;3
-7.5	-77.5	552;4
-2.5	-77.5	552;3
2.5	-77.5	587;3
7.5	-77.5	587;4
12.5	-77.5	586;3
17.5	-77.5	586;4
22.5	-77.5	585;3
27.5	-77.5	585;4
32.5	-77.5	584;3

Longitude	Latitude	Marsden
37.5	-77.5	584;4
42.5	-77.5	583;3
47.5	-77.5	583;4
52.5	-77.5	582;3
57.5	-77.5	582;4
62.5	-77.5	581;3
67.5	-77.5	581;4
72.5	-77.5	580;3
77.5	-77.5	580;4
82.5	-77.5	579;3
87.5	-77.5	579;4
92.5	-77.5	578;3
97.5	-77.5	578;4
102.5	-77.5	577;3
107.5	-77.5	577;4
112.5	-77.5	576;3
117.5	-77.5	576;4
122.5	-77.5	575;3
127.5	-77.5	575;4
132.5	-77.5	574;3
137.5	-77.5	574;4
142.5	-77.5	573;3
147.5	-77.5	573;4
152.5	-77.5	572;3
157.5	-77.5	572;4
162.5	-77.5	571;3
167.5	-77.5	571;4
172.5	-77.5	570;3
-177.5	-72.5	569;2
-172.5	-72.5	569;1
-167.5	-72.5	568;2
-162.5	-72.5	568;1
-157.5	-72.5	567;2
-152.5	-72.5	567;1
-147.5	-72.5	566;2
-142.5	-72.5	566;1
-137.5	-72.5	565;2
-132.5	-72.5	565;1

Longitude	Latitude	Marsden
-127.5	-72.5	564;2
-122.5	-72.5	564;1
-117.5	-72.5	563;2
-112.5	-72.5	563;1
-107.5	-72.5	562;2
-102.5	-72.5	562;1
-97.5	-72.5	561;2
-92.5	-72.5	561;1
-87.5	-72.5	560;2
-82.5	-72.5	560;1
-77.5	-72.5	559;2
-72.5	-72.5	559;1
-67.5	-72.5	558;2
-62.5	-72.5	558;1
-57.5	-72.5	557;2
-52.5	-72.5	557;1
-47.5	-72.5	556;2
-42.5	-72.5	556;1
-37.5	-72.5	555;2
-32.5	-72.5	555;1
-27.5	-72.5	554;2
-22.5	-72.5	554;1
-17.5	-72.5	553;2
-12.5	-72.5	553;1
-7.5	-72.5	552;2
-2.5	-72.5	552;1
2.5	-72.5	587;1
7.5	-72.5	587;2
12.5	-72.5	586;1
17.5	-72.5	586;2
22.5	-72.5	585;1
27.5	-72.5	585;2
32.5	-72.5	584;1
37.5	-72.5	584;2
42.5	-72.5	583;1
47.5	-72.5	583;2
52.5	-72.5	582;1
57.5	-72.5	582;2

Longitude	Latitude	Marsden
62.5	-72.5	581;1
67.5	-72.5	581;2
72.5	-72.5	580;1
77.5	-72.5	580;2
82.5	-72.5	579;1
87.5	-72.5	579;2
92.5	-72.5	578;1
97.5	-72.5	578;2
102.5	-72.5	577;1
107.5	-72.5	577;2
112.5	-72.5	576;1
117.5	-72.5	576;2
122.5	-72.5	575;1
127.5	-72.5	575;2
132.5	-72.5	574;1
137.5	-72.5	574;2
142.5	-72.5	573;1
147.5	-72.5	573;2
152.5	-72.5	572;1
157.5	-72.5	572;2
162.5	-72.5	571;1
167.5	-72.5	571;2
172.5	-72.5	570;1
-177.5	-67.5	533;4
-172.5	-67.5	533;3
-167.5	-67.5	532;4
-162.5	-67.5	532;3
-157.5	-67.5	531;4
-152.5	-67.5	531;3
-147.5	-67.5	530;4
-142.5	-67.5	530;3
-137.5	-67.5	529;4
-132.5	-67.5	529;3
-127.5	-67.5	528;4
-122.5	-67.5	528;3
-117.5	-67.5	527;4
-112.5	-67.5	527;3
-107.5	-67.5	526;4

Longitude	Latitude	Marsden
-102.5	-67.5	526;3
-97.5	-67.5	525;4
-92.5	-67.5	525;3
-87.5	-67.5	524;4
-82.5	-67.5	524;3
-77.5	-67.5	523;4
-72.5	-67.5	523;3
-67.5	-67.5	522;4
-62.5	-67.5	522;3
-57.5	-67.5	521;4
-52.5	-67.5	521;3
-47.5	-67.5	520;4
-42.5	-67.5	520;3
-37.5	-67.5	519;4
-32.5	-67.5	519;3
-27.5	-67.5	518;4
-22.5	-67.5	518;3
-17.5	-67.5	517;4
-12.5	-67.5	517;3
-7.5	-67.5	516;4
-2.5	-67.5	516;3
2.5	-67.5	551;3
7.5	-67.5	551;4
12.5	-67.5	550;3
17.5	-67.5	550;4
22.5	-67.5	549;3
27.5	-67.5	549;4
32.5	-67.5	548;3
37.5	-67.5	548;4
42.5	-67.5	547;3
47.5	-67.5	547;4
52.5	-67.5	546;3
57.5	-67.5	546;4
62.5	-67.5	545;3
67.5	-67.5	545;4
72.5	-67.5	544;3
77.5	-67.5	544;4
82.5	-67.5	543;3

Longitude	Latitude	Marsden
87.5	-67.5	543;4
92.5	-67.5	542;3
97.5	-67.5	542;4
102.5	-67.5	541;3
107.5	-67.5	541;4
112.5	-67.5	540;3
117.5	-67.5	540;4
122.5	-67.5	539;3
127.5	-67.5	539;4
132.5	-67.5	538;3
137.5	-67.5	538;4
142.5	-67.5	537;3
147.5	-67.5	537;4
152.5	-67.5	536;3
157.5	-67.5	536;4
162.5	-67.5	535;3
167.5	-67.5	535;4
172.5	-67.5	534;3
-177.5	-62.5	533;2
-172.5	-62.5	533;1
-167.5	-62.5	532;2
-162.5	-62.5	532;1
-157.5	-62.5	531;2
-152.5	-62.5	531;1
-147.5	-62.5	530;2
-142.5	-62.5	530;1
-137.5	-62.5	529;2
-132.5	-62.5	529;1
-127.5	-62.5	528;2
-122.5	-62.5	528;1
-117.5	-62.5	527;2
-112.5	-62.5	527;1
-107.5	-62.5	526;2
-102.5	-62.5	526;1
-97.5	-62.5	525;2
-92.5	-62.5	525;1
-87.5	-62.5	524;2
-82.5	-62.5	524;1

Longitude	Latitude	Marsden
-77.5	-62.5	523;2
-72.5	-62.5	523;1
-67.5	-62.5	522;2
-62.5	-62.5	522;1
-57.5	-62.5	521;2
-52.5	-62.5	521;1
-47.5	-62.5	520;2
-42.5	-62.5	520;1
-37.5	-62.5	519;2
-32.5	-62.5	519;1
-27.5	-62.5	518;2
-22.5	-62.5	518;1
-17.5	-62.5	517;2
-12.5	-62.5	517;1
-7.5	-62.5	516;2
-2.5	-62.5	516;1
2.5	-62.5	551;1
7.5	-62.5	551;2
12.5	-62.5	550;1
17.5	-62.5	550;2
22.5	-62.5	549;1
27.5	-62.5	549;2
32.5	-62.5	548;1
37.5	-62.5	548;2
42.5	-62.5	547;1
47.5	-62.5	547;2
52.5	-62.5	546;1
57.5	-62.5	546;2
62.5	-62.5	545;1
67.5	-62.5	545;2
72.5	-62.5	544;1
77.5	-62.5	544;2
82.5	-62.5	543;1
87.5	-62.5	543;2
92.5	-62.5	542;1
97.5	-62.5	542;2
102.5	-62.5	541;1
107.5	-62.5	541;2

Longitude	Latitude	Marsden
112.5	-62.5	540;1
117.5	-62.5	540;2
122.5	-62.5	539;1
127.5	-62.5	539;2
132.5	-62.5	538;1
137.5	-62.5	538;2
142.5	-62.5	537;1
147.5	-62.5	537;2
152.5	-62.5	536;1
157.5	-62.5	536;2
162.5	-62.5	535;1
167.5	-62.5	535;2
172.5	-62.5	534;1
-177.5	-57.5	497;4
-172.5	-57.5	497;3
-167.5	-57.5	496;4
-162.5	-57.5	496;3
-157.5	-57.5	495;4
-152.5	-57.5	495;3
-147.5	-57.5	494;4
-142.5	-57.5	494;3
-137.5	-57.5	493;4
-132.5	-57.5	493;3
-127.5	-57.5	492;4
-122.5	-57.5	492;3
-117.5	-57.5	491;4
-112.5	-57.5	491;3
-107.5	-57.5	490;4
-102.5	-57.5	490;3
-97.5	-57.5	489;4
-92.5	-57.5	489;3
-87.5	-57.5	488;4
-82.5	-57.5	488;3
-77.5	-57.5	487;4
-72.5	-57.5	487;3
-67.5	-57.5	486;4
-62.5	-57.5	486;3
-57.5	-57.5	485;4

Longitude	Latitude	Marsden
-52.5	-57.5	485;3
-47.5	-57.5	484;4
-42.5	-57.5	484;3
-37.5	-57.5	483;4
-32.5	-57.5	483;3
-27.5	-57.5	482;4
-22.5	-57.5	482;3
-17.5	-57.5	481;4
-12.5	-57.5	481;3
-7.5	-57.5	480;4
-2.5	-57.5	480;3
2.5	-57.5	515;3
7.5	-57.5	515;4
12.5	-57.5	514;3
17.5	-57.5	514;4
22.5	-57.5	513;3
27.5	-57.5	513;4
32.5	-57.5	512;3
37.5	-57.5	512;4
42.5	-57.5	511;3
47.5	-57.5	511;4
52.5	-57.5	510;3
57.5	-57.5	510;4
62.5	-57.5	509;3
67.5	-57.5	509;4
72.5	-57.5	508;3
77.5	-57.5	508;4
82.5	-57.5	507;3
87.5	-57.5	507;4
92.5	-57.5	506;3
97.5	-57.5	506;4
102.5	-57.5	505;3
107.5	-57.5	505;4
112.5	-57.5	504;3
117.5	-57.5	504;4
122.5	-57.5	503;3
127.5	-57.5	503;4
132.5	-57.5	502;3

Longitude	Latitude	Marsden
137.5	-57.5	502;4
142.5	-57.5	501;3
147.5	-57.5	501;4
152.5	-57.5	500;3
157.5	-57.5	500;4
162.5	-57.5	499;3
167.5	-57.5	499;4
172.5	-57.5	498;3
-177.5	-52.5	497;2
-172.5	-52.5	497;1
-167.5	-52.5	496;2
-162.5	-52.5	496;1
-157.5	-52.5	495;2
-152.5	-52.5	495;1
-147.5	-52.5	494;2
-142.5	-52.5	494;1
-137.5	-52.5	493;2
-132.5	-52.5	493;1
-127.5	-52.5	492;2
-122.5	-52.5	492;1
-117.5	-52.5	491;2
-112.5	-52.5	491;1
-107.5	-52.5	490;2
-102.5	-52.5	490;1
-97.5	-52.5	489;2
-92.5	-52.5	489;1
-87.5	-52.5	488;2
-82.5	-52.5	488;1
-77.5	-52.5	487;2
-72.5	-52.5	487;1
-67.5	-52.5	486;2
-62.5	-52.5	486;1
-57.5	-52.5	485;2
-52.5	-52.5	485;1
-47.5	-52.5	484;2
-42.5	-52.5	484;1
-37.5	-52.5	483;2
-32.5	-52.5	483;1

Longitude	Latitude	Marsden
-27.5	-52.5	482;2
-22.5	-52.5	482;1
-17.5	-52.5	481;2
-12.5	-52.5	481;1
-7.5	-52.5	480;2
-2.5	-52.5	480;1
2.5	-52.5	515;1
7.5	-52.5	515;2
12.5	-52.5	514;1
17.5	-52.5	514;2
22.5	-52.5	513;1
27.5	-52.5	513;2
32.5	-52.5	512;1
37.5	-52.5	512;2
42.5	-52.5	511;1
47.5	-52.5	511;2
52.5	-52.5	510;1
57.5	-52.5	510;2
62.5	-52.5	509;1
67.5	-52.5	509;2
72.5	-52.5	508;1
77.5	-52.5	508;2
82.5	-52.5	507;1
87.5	-52.5	507;2
92.5	-52.5	506;1
97.5	-52.5	506;2
102.5	-52.5	505;1
107.5	-52.5	505;2
112.5	-52.5	504;1
117.5	-52.5	504;2
122.5	-52.5	503;1
127.5	-52.5	503;2
132.5	-52.5	502;1
137.5	-52.5	502;2
142.5	-52.5	501;1
147.5	-52.5	501;2
152.5	-52.5	500;1
157.5	-52.5	500;2

Longitude	Latitude	Marsden
162.5	-52.5	499;1
167.5	-52.5	499;2
172.5	-52.5	498;1
-177.5	-47.5	461;4
-172.5	-47.5	461;3
-167.5	-47.5	460;4
-162.5	-47.5	460;3
-157.5	-47.5	459;4
-152.5	-47.5	459;3
-147.5	-47.5	458;4
-142.5	-47.5	458;3
-137.5	-47.5	457;4
-132.5	-47.5	457;3
-127.5	-47.5	456;4
-122.5	-47.5	456;3
-117.5	-47.5	455;4
-112.5	-47.5	455;3
-107.5	-47.5	454;4
-102.5	-47.5	454;3
-97.5	-47.5	453;4
-92.5	-47.5	453;3
-87.5	-47.5	452;4
-82.5	-47.5	452;3
-77.5	-47.5	451;4
-72.5	-47.5	451;3
-67.5	-47.5	450;4
-62.5	-47.5	450;3
-57.5	-47.5	449;4
-52.5	-47.5	449;3
-47.5	-47.5	448;4
-42.5	-47.5	448;3
-37.5	-47.5	447;4
-32.5	-47.5	447;3
-27.5	-47.5	446;4
-22.5	-47.5	446;3
-17.5	-47.5	445;4
-12.5	-47.5	445;3
-7.5	-47.5	444;4

Longitude	Latitude	Marsden
-2.5	-47.5	444;3
2.5	-47.5	479;3
7.5	-47.5	479;4
12.5	-47.5	478;3
17.5	-47.5	478;4
22.5	-47.5	477;3
27.5	-47.5	477;4
32.5	-47.5	476;3
37.5	-47.5	476;4
42.5	-47.5	475;3
47.5	-47.5	475;4
52.5	-47.5	474;3
57.5	-47.5	474;4
62.5	-47.5	473;3
67.5	-47.5	473;4
72.5	-47.5	472;3
77.5	-47.5	472;4
82.5	-47.5	471;3
87.5	-47.5	471;4
92.5	-47.5	470;3
97.5	-47.5	470;4
102.5	-47.5	469;3
107.5	-47.5	469;4
112.5	-47.5	468;3
117.5	-47.5	468;4
122.5	-47.5	467;3
127.5	-47.5	467;4
132.5	-47.5	466;3
137.5	-47.5	466;4
142.5	-47.5	465;3
147.5	-47.5	465;4
152.5	-47.5	464;3
157.5	-47.5	464;4
162.5	-47.5	463;3
167.5	-47.5	463;4
172.5	-47.5	462;3
-177.5	-42.5	461;2
-172.5	-42.5	461;1

Longitude	Latitude	Marsden
-167.5	-42.5	460;2
-162.5	-42.5	460;1
-157.5	-42.5	459;2
-152.5	-42.5	459;1
-147.5	-42.5	458;2
-142.5	-42.5	458;1
-137.5	-42.5	457;2
-132.5	-42.5	457;1
-127.5	-42.5	456;2
-122.5	-42.5	456;1
-117.5	-42.5	455;2
-112.5	-42.5	455;1
-107.5	-42.5	454;2
-102.5	-42.5	454;1
-97.5	-42.5	453;2
-92.5	-42.5	453;1
-87.5	-42.5	452;2
-82.5	-42.5	452;1
-77.5	-42.5	451;2
-72.5	-42.5	451;1
-67.5	-42.5	450;2
-62.5	-42.5	450;1
-57.5	-42.5	449;2
-52.5	-42.5	449;1
-47.5	-42.5	448;2
-42.5	-42.5	448;1
-37.5	-42.5	447;2
-32.5	-42.5	447;1
-27.5	-42.5	446;2
-22.5	-42.5	446;1
-17.5	-42.5	445;2
-12.5	-42.5	445;1
-7.5	-42.5	444;2
-2.5	-42.5	444;1
2.5	-42.5	479;1
7.5	-42.5	479;2
12.5	-42.5	478;1
17.5	-42.5	478;2

Longitude	Latitude	Marsden
22.5	-42.5	477;1
27.5	-42.5	477;2
32.5	-42.5	476;1
37.5	-42.5	476;2
42.5	-42.5	475;1
47.5	-42.5	475;2
52.5	-42.5	474;1
57.5	-42.5	474;2
62.5	-42.5	473;1
67.5	-42.5	473;2
72.5	-42.5	472;1
77.5	-42.5	472;2
82.5	-42.5	471;1
87.5	-42.5	471;2
92.5	-42.5	470;1
97.5	-42.5	470;2
102.5	-42.5	469;1
107.5	-42.5	469;2
112.5	-42.5	468;1
117.5	-42.5	468;2
122.5	-42.5	467;1
127.5	-42.5	467;2
132.5	-42.5	466;1
137.5	-42.5	466;2
142.5	-42.5	465;1
147.5	-42.5	465;2
152.5	-42.5	464;1
157.5	-42.5	464;2
162.5	-42.5	463;1
167.5	-42.5	463;2
172.5	-42.5	462;1
-177.5	-37.5	425;4
-172.5	-37.5	425;3
-167.5	-37.5	424;4
-162.5	-37.5	424;3
-157.5	-37.5	423;4
-152.5	-37.5	423;3
-147.5	-37.5	422;4

Longitude	Latitude	Marsden
-142.5	-37.5	422;3
-137.5	-37.5	421;4
-132.5	-37.5	421;3
-127.5	-37.5	420;4
-122.5	-37.5	420;3
-117.5	-37.5	419;4
-112.5	-37.5	419;3
-107.5	-37.5	418;4
-102.5	-37.5	418;3
-97.5	-37.5	417;4
-92.5	-37.5	417;3
-87.5	-37.5	416;4
-82.5	-37.5	416;3
-77.5	-37.5	415;4
-72.5	-37.5	415;3
-67.5	-37.5	414;4
-62.5	-37.5	414;3
-57.5	-37.5	413;4
-52.5	-37.5	413;3
-47.5	-37.5	412;4
-42.5	-37.5	412;3
-37.5	-37.5	411;4
-32.5	-37.5	411;3
-27.5	-37.5	410;4
-22.5	-37.5	410;3
-17.5	-37.5	409;4
-12.5	-37.5	409;3
-7.5	-37.5	408;4
-2.5	-37.5	408;3
2.5	-37.5	443;3
7.5	-37.5	443;4
12.5	-37.5	442;3
17.5	-37.5	442;4
22.5	-37.5	441;3
27.5	-37.5	441;4
32.5	-37.5	440;3
37.5	-37.5	440;4
42.5	-37.5	439;3

Longitude	Latitude	Marsden
47.5	-37.5	439;4
52.5	-37.5	438;3
57.5	-37.5	438;4
62.5	-37.5	437;3
67.5	-37.5	437;4
72.5	-37.5	436;3
77.5	-37.5	436;4
82.5	-37.5	435;3
87.5	-37.5	435;4
92.5	-37.5	434;3
97.5	-37.5	434;4
102.5	-37.5	433;3
107.5	-37.5	433;4
112.5	-37.5	432;3
117.5	-37.5	432;4
122.5	-37.5	431;3
127.5	-37.5	431;4
132.5	-37.5	430;3
137.5	-37.5	430;4
142.5	-37.5	429;3
147.5	-37.5	429;4
152.5	-37.5	428;3
157.5	-37.5	428;4
162.5	-37.5	427;3
167.5	-37.5	427;4
172.5	-37.5	426;3
-177.5	-32.5	425;2
-172.5	-32.5	425;1
-167.5	-32.5	424;2
-162.5	-32.5	424;1
-157.5	-32.5	423;2
-152.5	-32.5	423;1
-147.5	-32.5	422;2
-142.5	-32.5	422;1
-137.5	-32.5	421;2
-132.5	-32.5	421;1
-127.5	-32.5	420;2
-122.5	-32.5	420;1

Longitude	Latitude	Marsden
-117.5	-32.5	419;2
-112.5	-32.5	419;1
-107.5	-32.5	418;2
-102.5	-32.5	418;1
-97.5	-32.5	417;2
-92.5	-32.5	417;1
-87.5	-32.5	416;2
-82.5	-32.5	416;1
-77.5	-32.5	415;2
-72.5	-32.5	415;1
-67.5	-32.5	414;2
-62.5	-32.5	414;1
-57.5	-32.5	413;2
-52.5	-32.5	413;1
-47.5	-32.5	412;2
-42.5	-32.5	412;1
-37.5	-32.5	411;2
-32.5	-32.5	411;1
-27.5	-32.5	410;2
-22.5	-32.5	410;1
-17.5	-32.5	409;2
-12.5	-32.5	409;1
-7.5	-32.5	408;2
-2.5	-32.5	408;1
2.5	-32.5	443;1
7.5	-32.5	443;2
12.5	-32.5	442;1
17.5	-32.5	442;2
22.5	-32.5	441;1
27.5	-32.5	441;2
32.5	-32.5	440;1
37.5	-32.5	440;2
42.5	-32.5	439;1
47.5	-32.5	439;2
52.5	-32.5	438;1
57.5	-32.5	438;2
62.5	-32.5	437;1
67.5	-32.5	437;2

Longitude	Latitude	Marsden
72.5	-32.5	436;1
77.5	-32.5	436;2
82.5	-32.5	435;1
87.5	-32.5	435;2
92.5	-32.5	434;1
97.5	-32.5	434;2
102.5	-32.5	433;1
107.5	-32.5	433;2
112.5	-32.5	432;1
117.5	-32.5	432;2
122.5	-32.5	431;1
127.5	-32.5	431;2
132.5	-32.5	430;1
137.5	-32.5	430;2
142.5	-32.5	429;1
147.5	-32.5	429;2
152.5	-32.5	428;1
157.5	-32.5	428;2
162.5	-32.5	427;1
167.5	-32.5	427;2
172.5	-32.5	426;1
-177.5	-27.5	389;4
-172.5	-27.5	389;3
-167.5	-27.5	388;4
-162.5	-27.5	388;3
-157.5	-27.5	387;4
-152.5	-27.5	387;3
-147.5	-27.5	386;4
-142.5	-27.5	386;3
-137.5	-27.5	385;4
-132.5	-27.5	385;3
-127.5	-27.5	384;4
-122.5	-27.5	384;3
-117.5	-27.5	383;4
-112.5	-27.5	383;3
-107.5	-27.5	382;4
-102.5	-27.5	382;3
-97.5	-27.5	381;4

Longitude	Latitude	Marsden
-92.5	-27.5	381;3
-87.5	-27.5	380;4
-82.5	-27.5	380;3
-77.5	-27.5	379;4
-72.5	-27.5	379;3
-67.5	-27.5	378;4
-62.5	-27.5	378;3
-57.5	-27.5	377;4
-52.5	-27.5	377;3
-47.5	-27.5	376;4
-42.5	-27.5	376;3
-37.5	-27.5	375;4
-32.5	-27.5	375;3
-27.5	-27.5	374;4
-22.5	-27.5	374;3
-17.5	-27.5	373;4
-12.5	-27.5	373;3
-7.5	-27.5	372;4
-2.5	-27.5	372;3
2.5	-27.5	407;3
7.5	-27.5	407;4
12.5	-27.5	406;3
17.5	-27.5	406;4
22.5	-27.5	405;3
27.5	-27.5	405;4
32.5	-27.5	404;3
37.5	-27.5	404;4
42.5	-27.5	403;3
47.5	-27.5	403;4
52.5	-27.5	402;3
57.5	-27.5	402;4
62.5	-27.5	401;3
67.5	-27.5	401;4
72.5	-27.5	400;3
77.5	-27.5	400;4
82.5	-27.5	399;3
87.5	-27.5	399;4
92.5	-27.5	398;3

Longitude	Latitude	Marsden
97.5	-27.5	398;4
102.5	-27.5	397;3
107.5	-27.5	397;4
112.5	-27.5	396;3
117.5	-27.5	396;4
122.5	-27.5	395;3
127.5	-27.5	395;4
132.5	-27.5	394;3
137.5	-27.5	394;4
142.5	-27.5	393;3
147.5	-27.5	393;4
152.5	-27.5	392;3
157.5	-27.5	392;4
162.5	-27.5	391;3
167.5	-27.5	391;4
172.5	-27.5	390;3
-177.5	-22.5	389;2
-172.5	-22.5	389;1
-167.5	-22.5	388;2
-162.5	-22.5	388;1
-157.5	-22.5	387;2
-152.5	-22.5	387;1
-147.5	-22.5	386;2
-142.5	-22.5	386;1
-137.5	-22.5	385;2
-132.5	-22.5	385;1
-127.5	-22.5	384;2
-122.5	-22.5	384;1
-117.5	-22.5	383;2
-112.5	-22.5	383;1
-107.5	-22.5	382;2
-102.5	-22.5	382;1
-97.5	-22.5	381;2
-92.5	-22.5	381;1
-87.5	-22.5	380;2
-82.5	-22.5	380;1
-77.5	-22.5	379;2
-72.5	-22.5	379;1

Longitude	Latitude	Marsden
-67.5	-22.5	378;2
-62.5	-22.5	378;1
-57.5	-22.5	377;2
-52.5	-22.5	377;1
-47.5	-22.5	376;2
-42.5	-22.5	376;1
-37.5	-22.5	375;2
-32.5	-22.5	375;1
-27.5	-22.5	374;2
-22.5	-22.5	374;1
-17.5	-22.5	373;2
-12.5	-22.5	373;1
-7.5	-22.5	372;2
-2.5	-22.5	372;1
2.5	-22.5	407;1
7.5	-22.5	407;2
12.5	-22.5	406;1
17.5	-22.5	406;2
22.5	-22.5	405;1
27.5	-22.5	405;2
32.5	-22.5	404;1
37.5	-22.5	404;2
42.5	-22.5	403;1
47.5	-22.5	403;2
52.5	-22.5	402;1
57.5	-22.5	402;2
62.5	-22.5	401;1
67.5	-22.5	401;2
72.5	-22.5	400;1
77.5	-22.5	400;2
82.5	-22.5	399;1
87.5	-22.5	399;2
92.5	-22.5	398;1
97.5	-22.5	398;2
102.5	-22.5	397;1
107.5	-22.5	397;2
112.5	-22.5	396;1
117.5	-22.5	396;2

Longitude	Latitude	Marsden
122.5	-22.5	395;1
127.5	-22.5	395;2
132.5	-22.5	394;1
137.5	-22.5	394;2
142.5	-22.5	393;1
147.5	-22.5	393;2
152.5	-22.5	392;1
157.5	-22.5	392;2
162.5	-22.5	391;1
167.5	-22.5	391;2
172.5	-22.5	390;1
-177.5	-17.5	353;4
-172.5	-17.5	353;3
-167.5	-17.5	352;4
-162.5	-17.5	352;3
-157.5	-17.5	351;4
-152.5	-17.5	351;3
-147.5	-17.5	350;4
-142.5	-17.5	350;3
-137.5	-17.5	349;4
-132.5	-17.5	349;3
-127.5	-17.5	348;4
-122.5	-17.5	348;3
-117.5	-17.5	347;4
-112.5	-17.5	347;3
-107.5	-17.5	346;4
-102.5	-17.5	346;3
-97.5	-17.5	345;4
-92.5	-17.5	345;3
-87.5	-17.5	344;4
-82.5	-17.5	344;3
-77.5	-17.5	343;4
-72.5	-17.5	343;3
-67.5	-17.5	342;4
-62.5	-17.5	342;3
-57.5	-17.5	341;4
-52.5	-17.5	341;3
-47.5	-17.5	340;4

Longitude	Latitude	Marsden
-42.5	-17.5	340;3
-37.5	-17.5	339;4
-32.5	-17.5	339;3
-27.5	-17.5	338;4
-22.5	-17.5	338;3
-17.5	-17.5	337;4
-12.5	-17.5	337;3
-7.5	-17.5	336;4
-2.5	-17.5	336;3
2.5	-17.5	371;3
7.5	-17.5	371;4
12.5	-17.5	370;3
17.5	-17.5	370;4
22.5	-17.5	369;3
27.5	-17.5	369;4
32.5	-17.5	368;3
37.5	-17.5	368;4
42.5	-17.5	367;3
47.5	-17.5	367;4
52.5	-17.5	366;3
57.5	-17.5	366;4
62.5	-17.5	365;3
67.5	-17.5	365;4
72.5	-17.5	364;3
77.5	-17.5	364;4
82.5	-17.5	363;3
87.5	-17.5	363;4
92.5	-17.5	362;3
97.5	-17.5	362;4
102.5	-17.5	361;3
107.5	-17.5	361;4
112.5	-17.5	360;3
117.5	-17.5	360;4
122.5	-17.5	359;3
127.5	-17.5	359;4
132.5	-17.5	358;3
137.5	-17.5	358;4
142.5	-17.5	357;3

Longitude	Latitude	Marsden
147.5	-17.5	357;4
152.5	-17.5	356;3
157.5	-17.5	356;4
162.5	-17.5	355;3
167.5	-17.5	355;4
172.5	-17.5	354;3
-177.5	-12.5	353;2
-172.5	-12.5	353;1
-167.5	-12.5	352;2
-162.5	-12.5	352;1
-157.5	-12.5	351;2
-152.5	-12.5	351;1
-147.5	-12.5	350;2
-142.5	-12.5	350;1
-137.5	-12.5	349;2
-132.5	-12.5	349;1
-127.5	-12.5	348;2
-122.5	-12.5	348;1
-117.5	-12.5	347;2
-112.5	-12.5	347;1
-107.5	-12.5	346;2
-102.5	-12.5	346;1
-97.5	-12.5	345;2
-92.5	-12.5	345;1
-87.5	-12.5	344;2
-82.5	-12.5	344;1
-77.5	-12.5	343;2
-72.5	-12.5	343;1
-67.5	-12.5	342;2
-62.5	-12.5	342;1
-57.5	-12.5	341;2
-52.5	-12.5	341;1
-47.5	-12.5	340;2
-42.5	-12.5	340;1
-37.5	-12.5	339;2
-32.5	-12.5	339;1
-27.5	-12.5	338;2
-22.5	-12.5	338;1

Longitude	Latitude	Marsden
-17.5	-12.5	337;2
-12.5	-12.5	337;1
-7.5	-12.5	336;2
-2.5	-12.5	336;1
2.5	-12.5	371;1
7.5	-12.5	371;2
12.5	-12.5	370;1
17.5	-12.5	370;2
22.5	-12.5	369;1
27.5	-12.5	369;2
32.5	-12.5	368;1
37.5	-12.5	368;2
42.5	-12.5	367;1
47.5	-12.5	367;2
52.5	-12.5	366;1
57.5	-12.5	366;2
62.5	-12.5	365;1
67.5	-12.5	365;2
72.5	-12.5	364;1
77.5	-12.5	364;2
82.5	-12.5	363;1
87.5	-12.5	363;2
92.5	-12.5	362;1
97.5	-12.5	362;2
102.5	-12.5	361;1
107.5	-12.5	361;2
112.5	-12.5	360;1
117.5	-12.5	360;2
122.5	-12.5	359;1
127.5	-12.5	359;2
132.5	-12.5	358;1
137.5	-12.5	358;2
142.5	-12.5	357;1
147.5	-12.5	357;2
152.5	-12.5	356;1
157.5	-12.5	356;2
162.5	-12.5	355;1
167.5	-12.5	355;2

Longitude	Latitude	Marsden
172.5	-12.5	354;1
-177.5	-7.5	317;4
-172.5	-7.5	317;3
-167.5	-7.5	316;4
-162.5	-7.5	316;3
-157.5	-7.5	315;4
-152.5	-7.5	315;3
-147.5	-7.5	314;4
-142.5	-7.5	314;3
-137.5	-7.5	313;4
-132.5	-7.5	313;3
-127.5	-7.5	312;4
-122.5	-7.5	312;3
-117.5	-7.5	311;4
-112.5	-7.5	311;3
-107.5	-7.5	310;4
-102.5	-7.5	310;3
-97.5	-7.5	309;4
-92.5	-7.5	309;3
-87.5	-7.5	308;4
-82.5	-7.5	308;3
-77.5	-7.5	307;4
-72.5	-7.5	307;3
-67.5	-7.5	306;4
-62.5	-7.5	306;3
-57.5	-7.5	305;4
-52.5	-7.5	305;3
-47.5	-7.5	304;4
-42.5	-7.5	304;3
-37.5	-7.5	303;4
-32.5	-7.5	303;3
-27.5	-7.5	302;4
-22.5	-7.5	302;3
-17.5	-7.5	301;4
-12.5	-7.5	301;3
-7.5	-7.5	300;4
-2.5	-7.5	300;3
2.5	-7.5	335;3

Longitude	Latitude	Marsden
7.5	-7.5	335;4
12.5	-7.5	334;3
17.5	-7.5	334;4
22.5	-7.5	333;3
27.5	-7.5	333;4
32.5	-7.5	332;3
37.5	-7.5	332;4
42.5	-7.5	331;3
47.5	-7.5	331;4
52.5	-7.5	330;3
57.5	-7.5	330;4
62.5	-7.5	329;3
67.5	-7.5	329;4
72.5	-7.5	328;3
77.5	-7.5	328;4
82.5	-7.5	327;3
87.5	-7.5	327;4
92.5	-7.5	326;3
97.5	-7.5	326;4
102.5	-7.5	325;3
107.5	-7.5	325;4
112.5	-7.5	324;3
117.5	-7.5	324;4
122.5	-7.5	323;3
127.5	-7.5	323;4
132.5	-7.5	322;3
137.5	-7.5	322;4
142.5	-7.5	321;3
147.5	-7.5	321;4
152.5	-7.5	320;3
157.5	-7.5	320;4
162.5	-7.5	319;3
167.5	-7.5	319;4
172.5	-7.5	318;3
-177.5	-2.5	317;2
-172.5	-2.5	317;1
-167.5	-2.5	316;2
-162.5	-2.5	316;1

Longitude	Latitude	Marsden
-157.5	-2.5	315;2
-152.5	-2.5	315;1
-147.5	-2.5	314;2
-142.5	-2.5	314;1
-137.5	-2.5	313;2
-132.5	-2.5	313;1
-127.5	-2.5	312;2
-122.5	-2.5	312;1
-117.5	-2.5	311;2
-112.5	-2.5	311;1
-107.5	-2.5	310;2
-102.5	-2.5	310;1
-97.5	-2.5	309;2
-92.5	-2.5	309;1
-87.5	-2.5	308;2
-82.5	-2.5	308;1
-77.5	-2.5	307;2
-72.5	-2.5	307;1
-67.5	-2.5	306;2
-62.5	-2.5	306;1
-57.5	-2.5	305;2
-52.5	-2.5	305;1
-47.5	-2.5	304;2
-42.5	-2.5	304;1
-37.5	-2.5	303;2
-32.5	-2.5	303;1
-27.5	-2.5	302;2
-22.5	-2.5	302;1
-17.5	-2.5	301;2
-12.5	-2.5	301;1
-7.5	-2.5	300;2
-2.5	-2.5	300;1
2.5	-2.5	335;1
7.5	-2.5	335;2
12.5	-2.5	334;1
17.5	-2.5	334;2
22.5	-2.5	333;1
27.5	-2.5	333;2

Longitude	Latitude	Marsden
32.5	-2.5	332;1
37.5	-2.5	332;2
42.5	-2.5	331;1
47.5	-2.5	331;2
52.5	-2.5	330;1
57.5	-2.5	330;2
62.5	-2.5	329;1
67.5	-2.5	329;2
72.5	-2.5	328;1
77.5	-2.5	328;2
82.5	-2.5	327;1
87.5	-2.5	327;2
92.5	-2.5	326;1
97.5	-2.5	326;2
102.5	-2.5	325;1
107.5	-2.5	325;2
112.5	-2.5	324;1
117.5	-2.5	324;2
122.5	-2.5	323;1
127.5	-2.5	323;2
132.5	-2.5	322;1
137.5	-2.5	322;2
142.5	-2.5	321;1
147.5	-2.5	321;2
152.5	-2.5	320;1
157.5	-2.5	320;2
162.5	-2.5	319;1
167.5	-2.5	319;2
172.5	-2.5	318;1
-177.5	2.5	018;2
-172.5	2.5	018;1
-167.5	2.5	017;2
-162.5	2.5	017;1
-157.5	2.5	016;2
-152.5	2.5	016;1
-147.5	2.5	015;2
-142.5	2.5	015;1
-137.5	2.5	014;2

Longitude	Latitude	Marsden
-132.5	2.5	014;1
-127.5	2.5	013;2
-122.5	2.5	013;1
-117.5	2.5	012;2
-112.5	2.5	012;1
-107.5	2.5	011;2
-102.5	2.5	011;1
-97.5	2.5	010;2
-92.5	2.5	010;1
-87.5	2.5	009;2
-82.5	2.5	009;1
-77.5	2.5	008;2
-72.5	2.5	008;1
-67.5	2.5	007;2
-62.5	2.5	007;1
-57.5	2.5	006;2
-52.5	2.5	006;1
-47.5	2.5	005;2
-42.5	2.5	005;1
-37.5	2.5	004;2
-32.5	2.5	004;1
-27.5	2.5	003;2
-22.5	2.5	003;1
-17.5	2.5	002;2
-12.5	2.5	002;1
-7.5	2.5	001;2
-2.5	2.5	001;1
2.5	2.5	036;1
7.5	2.5	036;2
12.5	2.5	035;1
17.5	2.5	035;2
22.5	2.5	034;1
27.5	2.5	034;2
32.5	2.5	033;1
37.5	2.5	033;2
42.5	2.5	032;1
47.5	2.5	032;2
52.5	2.5	031;1

Longitude	Latitude	Marsden
57.5	2.5	031;2
62.5	2.5	030;1
67.5	2.5	030;2
72.5	2.5	029;1
77.5	2.5	029;2
82.5	2.5	028;1
87.5	2.5	028;2
92.5	2.5	027;1
97.5	2.5	027;2
102.5	2.5	026;1
107.5	2.5	026;2
112.5	2.5	025;1
117.5	2.5	025;2
122.5	2.5	024;1
127.5	2.5	024;2
132.5	2.5	023;1
137.5	2.5	023;2
142.5	2.5	022;1
147.5	2.5	022;2
152.5	2.5	021;1
157.5	2.5	021;2
162.5	2.5	020;1
167.5	2.5	020;2
172.5	2.5	019;1
-177.5	7.5	018;4
-172.5	7.5	018;3
-167.5	7.5	017;4
-162.5	7.5	017;3
-157.5	7.5	016;4
-152.5	7.5	016;3
-147.5	7.5	015;4
-142.5	7.5	015;3
-137.5	7.5	014;4
-132.5	7.5	014;3
-127.5	7.5	013;4
-122.5	7.5	013;3
-117.5	7.5	012;4
-112.5	7.5	012;3

Longitude	Latitude	Marsden
-107.5	7.5	011;4
-102.5	7.5	011;3
-97.5	7.5	010;4
-92.5	7.5	010;3
-87.5	7.5	009;4
-82.5	7.5	009;3
-77.5	7.5	008;4
-72.5	7.5	008;3
-67.5	7.5	007;4
-62.5	7.5	007;3
-57.5	7.5	006;4
-52.5	7.5	006;3
-47.5	7.5	005;4
-42.5	7.5	005;3
-37.5	7.5	004;4
-32.5	7.5	004;3
-27.5	7.5	003;4
-22.5	7.5	003;3
-17.5	7.5	002;4
-12.5	7.5	002;3
-7.5	7.5	001;4
-2.5	7.5	001;3
2.5	7.5	036;3
7.5	7.5	036;4
12.5	7.5	035;3
17.5	7.5	035;4
22.5	7.5	034;3
27.5	7.5	034;4
32.5	7.5	033;3
37.5	7.5	033;4
42.5	7.5	032;3
47.5	7.5	032;4
52.5	7.5	031;3
57.5	7.5	031;4
62.5	7.5	030;3
67.5	7.5	030;4
72.5	7.5	029;3
77.5	7.5	029;4

Longitude	Latitude	Marsden
82.5	7.5	028;3
87.5	7.5	028;4
92.5	7.5	027;3
97.5	7.5	027;4
102.5	7.5	026;3
107.5	7.5	026;4
112.5	7.5	025;3
117.5	7.5	025;4
122.5	7.5	024;3
127.5	7.5	024;4
132.5	7.5	023;3
137.5	7.5	023;4
142.5	7.5	022;3
147.5	7.5	022;4
152.5	7.5	021;3
157.5	7.5	021;4
162.5	7.5	020;3
167.5	7.5	020;4
172.5	7.5	019;3
-177.5	12.5	054;2
-172.5	12.5	054;1
-167.5	12.5	053;2
-162.5	12.5	053;1
-157.5	12.5	052;2
-152.5	12.5	052;1
-147.5	12.5	051;2
-142.5	12.5	051;1
-137.5	12.5	050;2
-132.5	12.5	050;1
-127.5	12.5	049;2
-122.5	12.5	049;1
-117.5	12.5	048;2
-112.5	12.5	048;1
-107.5	12.5	047;2
-102.5	12.5	047;1
-97.5	12.5	046;2
-92.5	12.5	046;1
-87.5	12.5	045;2

Longitude	Latitude	Marsden
-82.5	12.5	045;1
-77.5	12.5	044;2
-72.5	12.5	044;1
-67.5	12.5	043;2
-62.5	12.5	043;1
-57.5	12.5	042;2
-52.5	12.5	042;1
-47.5	12.5	041;2
-42.5	12.5	041;1
-37.5	12.5	040;2
-32.5	12.5	040;1
-27.5	12.5	039;2
-22.5	12.5	039;1
-17.5	12.5	038;2
-12.5	12.5	038;1
-7.5	12.5	037;2
-2.5	12.5	037;1
2.5	12.5	072;1
7.5	12.5	072;2
12.5	12.5	071;1
17.5	12.5	071;2
22.5	12.5	070;1
27.5	12.5	070;2
32.5	12.5	069;1
37.5	12.5	069;2
42.5	12.5	068;1
47.5	12.5	068;2
52.5	12.5	067;1
57.5	12.5	067;2
62.5	12.5	066;1
67.5	12.5	066;2
72.5	12.5	065;1
77.5	12.5	065;2
82.5	12.5	064;1
87.5	12.5	064;2
92.5	12.5	063;1
97.5	12.5	063;2
102.5	12.5	062;1

Longitude	Latitude	Marsden
107.5	12.5	062;2
112.5	12.5	061;1
117.5	12.5	061;2
122.5	12.5	060;1
127.5	12.5	060;2
132.5	12.5	059;1
137.5	12.5	059;2
142.5	12.5	058;1
147.5	12.5	058;2
152.5	12.5	057;1
157.5	12.5	057;2
162.5	12.5	056;1
167.5	12.5	056;2
172.5	12.5	055;1
-177.5	17.5	054;4
-172.5	17.5	054;3
-167.5	17.5	053;4
-162.5	17.5	053;3
-157.5	17.5	052;4
-152.5	17.5	052;3
-147.5	17.5	051;4
-142.5	17.5	051;3
-137.5	17.5	050;4
-132.5	17.5	050;3
-127.5	17.5	049;4
-122.5	17.5	049;3
-117.5	17.5	048;4
-112.5	17.5	048;3
-107.5	17.5	047;4
-102.5	17.5	047;3
-97.5	17.5	046;4
-92.5	17.5	046;3
-87.5	17.5	045;4
-82.5	17.5	045;3
-77.5	17.5	044;4
-72.5	17.5	044;3
-67.5	17.5	043;4
-62.5	17.5	043;3

Longitude	Latitude	Marsden
-57.5	17.5	042;4
-52.5	17.5	042;3
-47.5	17.5	041;4
-42.5	17.5	041;3
-37.5	17.5	040;4
-32.5	17.5	040;3
-27.5	17.5	039;4
-22.5	17.5	039;3
-17.5	17.5	038;4
-12.5	17.5	038;3
-7.5	17.5	037;4
-2.5	17.5	037;3
2.5	17.5	072;3
7.5	17.5	072;4
12.5	17.5	071;3
17.5	17.5	071;4
22.5	17.5	070;3
27.5	17.5	070;4
32.5	17.5	069;3
37.5	17.5	069;4
42.5	17.5	068;3
47.5	17.5	068;4
52.5	17.5	067;3
57.5	17.5	067;4
62.5	17.5	066;3
67.5	17.5	066;4
72.5	17.5	065;3
77.5	17.5	065;4
82.5	17.5	064;3
87.5	17.5	064;4
92.5	17.5	063;3
97.5	17.5	063;4
102.5	17.5	062;3
107.5	17.5	062;4
112.5	17.5	061;3
117.5	17.5	061;4
122.5	17.5	060;3
127.5	17.5	060;4

Longitude	Latitude	Marsden
132.5	17.5	059;3
137.5	17.5	059;4
142.5	17.5	058;3
147.5	17.5	058;4
152.5	17.5	057;3
157.5	17.5	057;4
162.5	17.5	056;3
167.5	17.5	056;4
172.5	17.5	055;3
-177.5	22.5	090;2
-172.5	22.5	090;1
-167.5	22.5	089;2
-162.5	22.5	089;1
-157.5	22.5	088;2
-152.5	22.5	088;1
-147.5	22.5	087;2
-142.5	22.5	087;1
-137.5	22.5	086;2
-132.5	22.5	086;1
-127.5	22.5	085;2
-122.5	22.5	085;1
-117.5	22.5	084;2
-112.5	22.5	084;1
-107.5	22.5	083;2
-102.5	22.5	083;1
-97.5	22.5	082;2
-92.5	22.5	082;1
-87.5	22.5	081;2
-82.5	22.5	081;1
-77.5	22.5	080;2
-72.5	22.5	080;1
-67.5	22.5	079;2
-62.5	22.5	079;1
-57.5	22.5	078;2
-52.5	22.5	078;1
-47.5	22.5	077;2
-42.5	22.5	077;1
-37.5	22.5	076;2

Longitude	Latitude	Marsden
-32.5	22.5	076;1
-27.5	22.5	075;2
-22.5	22.5	075;1
-17.5	22.5	074;2
-12.5	22.5	074;1
-7.5	22.5	073;2
-2.5	22.5	073;1
2.5	22.5	108;1
7.5	22.5	108;2
12.5	22.5	107;1
17.5	22.5	107;2
22.5	22.5	106;1
27.5	22.5	106;2
32.5	22.5	105;1
37.5	22.5	105;2
42.5	22.5	104;1
47.5	22.5	104;2
52.5	22.5	103;1
57.5	22.5	103;2
62.5	22.5	102;1
67.5	22.5	102;2
72.5	22.5	101;1
77.5	22.5	101;2
82.5	22.5	100;1
87.5	22.5	100;2
92.5	22.5	099;1
97.5	22.5	099;2
102.5	22.5	098;1
107.5	22.5	098;2
112.5	22.5	097;1
117.5	22.5	097;2
122.5	22.5	096;1
127.5	22.5	096;2
132.5	22.5	095;1
137.5	22.5	095;2
142.5	22.5	094;1
147.5	22.5	094;2
152.5	22.5	093;1

Longitude	Latitude	Marsden
157.5	22.5	093;2
162.5	22.5	092;1
167.5	22.5	092;2
172.5	22.5	091;1
-177.5	27.5	090;4
-172.5	27.5	090;3
-167.5	27.5	089;4
-162.5	27.5	089;3
-157.5	27.5	088;4
-152.5	27.5	088;3
-147.5	27.5	087;4
-142.5	27.5	087;3
-137.5	27.5	086;4
-132.5	27.5	086;3
-127.5	27.5	085;4
-122.5	27.5	085;3
-117.5	27.5	084;4
-112.5	27.5	084;3
-107.5	27.5	083;4
-102.5	27.5	083;3
-97.5	27.5	082;4
-92.5	27.5	082;3
-87.5	27.5	081;4
-82.5	27.5	081;3
-77.5	27.5	080;4
-72.5	27.5	080;3
-67.5	27.5	079;4
-62.5	27.5	079;3
-57.5	27.5	078;4
-52.5	27.5	078;3
-47.5	27.5	077;4
-42.5	27.5	077;3
-37.5	27.5	076;4
-32.5	27.5	076;3
-27.5	27.5	075;4
-22.5	27.5	075;3
-17.5	27.5	074;4
-12.5	27.5	074;3

Longitude	Latitude	Marsden
-7.5	27.5	073;4
-2.5	27.5	073;3
2.5	27.5	108;3
7.5	27.5	108;4
12.5	27.5	107;3
17.5	27.5	107;4
22.5	27.5	106;3
27.5	27.5	106;4
32.5	27.5	105;3
37.5	27.5	105;4
42.5	27.5	104;3
47.5	27.5	104;4
52.5	27.5	103;3
57.5	27.5	103;4
62.5	27.5	102;3
67.5	27.5	102;4
72.5	27.5	101;3
77.5	27.5	101;4
82.5	27.5	100;3
87.5	27.5	100;4
92.5	27.5	099;3
97.5	27.5	099;4
102.5	27.5	098;3
107.5	27.5	098;4
112.5	27.5	097;3
117.5	27.5	097;4
122.5	27.5	096;3
127.5	27.5	096;4
132.5	27.5	095;3
137.5	27.5	095;4
142.5	27.5	094;3
147.5	27.5	094;4
152.5	27.5	093;3
157.5	27.5	093;4
162.5	27.5	092;3
167.5	27.5	092;4
172.5	27.5	091;3
-177.5	32.5	126;2

Longitude	Latitude	Marsden
-172.5	32.5	126;1
-167.5	32.5	125;2
-162.5	32.5	125;1
-157.5	32.5	124;2
-152.5	32.5	124;1
-147.5	32.5	123;2
-142.5	32.5	123;1
-137.5	32.5	122;2
-132.5	32.5	122;1
-127.5	32.5	121;2
-122.5	32.5	121;1
-117.5	32.5	120;2
-112.5	32.5	120;1
-107.5	32.5	119;2
-102.5	32.5	119;1
-97.5	32.5	118;2
-92.5	32.5	118;1
-87.5	32.5	117;2
-82.5	32.5	117;1
-77.5	32.5	116;2
-72.5	32.5	116;1
-67.5	32.5	115;2
-62.5	32.5	115;1
-57.5	32.5	114;2
-52.5	32.5	114;1
-47.5	32.5	113;2
-42.5	32.5	113;1
-37.5	32.5	112;2
-32.5	32.5	112;1
-27.5	32.5	111;2
-22.5	32.5	111;1
-17.5	32.5	110;2
-12.5	32.5	110;1
-7.5	32.5	109;2
-2.5	32.5	109;1
2.5	32.5	144;1
7.5	32.5	144;2
12.5	32.5	143;1

Longitude	Latitude	Marsden
17.5	32.5	143;2
22.5	32.5	142;1
27.5	32.5	142;2
32.5	32.5	141;1
37.5	32.5	141;2
42.5	32.5	140;1
47.5	32.5	140;2
52.5	32.5	139;1
57.5	32.5	139;2
62.5	32.5	138;1
67.5	32.5	138;2
72.5	32.5	137;1
77.5	32.5	137;2
82.5	32.5	136;1
87.5	32.5	136;2
92.5	32.5	135;1
97.5	32.5	135;2
102.5	32.5	134;1
107.5	32.5	134;2
112.5	32.5	133;1
117.5	32.5	133;2
122.5	32.5	132;1
127.5	32.5	132;2
132.5	32.5	131;1
137.5	32.5	131;2
142.5	32.5	130;1
147.5	32.5	130;2
152.5	32.5	129;1
157.5	32.5	129;2
162.5	32.5	128;1
167.5	32.5	128;2
172.5	32.5	127;1
-177.5	37.5	126;4
-172.5	37.5	126;3
-167.5	37.5	125;4
-162.5	37.5	125;3
-157.5	37.5	124;4
-152.5	37.5	124;3

Longitude	Latitude	Marsden
-147.5	37.5	123;4
-142.5	37.5	123;3
-137.5	37.5	122;4
-132.5	37.5	122;3
-127.5	37.5	121;4
-122.5	37.5	121;3
-117.5	37.5	120;4
-112.5	37.5	120;3
-107.5	37.5	119;4
-102.5	37.5	119;3
-97.5	37.5	118;4
-92.5	37.5	118;3
-87.5	37.5	117;4
-82.5	37.5	117;3
-77.5	37.5	116;4
-72.5	37.5	116;3
-67.5	37.5	115;4
-62.5	37.5	115;3
-57.5	37.5	114;4
-52.5	37.5	114;3
-47.5	37.5	113;4
-42.5	37.5	113;3
-37.5	37.5	112;4
-32.5	37.5	112;3
-27.5	37.5	111;4
-22.5	37.5	111;3
-17.5	37.5	110;4
-12.5	37.5	110;3
-7.5	37.5	109;4
-2.5	37.5	109;3
2.5	37.5	144;3
7.5	37.5	144;4
12.5	37.5	143;3
17.5	37.5	143;4
22.5	37.5	142;3
27.5	37.5	142;4
32.5	37.5	141;3
37.5	37.5	141;4

Longitude	Latitude	Marsden
42.5	37.5	140;3
47.5	37.5	140;4
52.5	37.5	139;3
57.5	37.5	139;4
62.5	37.5	138;3
67.5	37.5	138;4
72.5	37.5	137;3
77.5	37.5	137;4
82.5	37.5	136;3
87.5	37.5	136;4
92.5	37.5	135;3
97.5	37.5	135;4
102.5	37.5	134;3
107.5	37.5	134;4
112.5	37.5	133;3
117.5	37.5	133;4
122.5	37.5	132;3
127.5	37.5	132;4
132.5	37.5	131;3
137.5	37.5	131;4
142.5	37.5	130;3
147.5	37.5	130;4
152.5	37.5	129;3
157.5	37.5	129;4
162.5	37.5	128;3
167.5	37.5	128;4
172.5	37.5	127;3
-177.5	42.5	162;2
-172.5	42.5	162;1
-167.5	42.5	161;2
-162.5	42.5	161;1
-157.5	42.5	160;2
-152.5	42.5	160;1
-147.5	42.5	159;2
-142.5	42.5	159;1
-137.5	42.5	158;2
-132.5	42.5	158;1
-127.5	42.5	157;2

Longitude	Latitude	Marsden
-122.5	42.5	157;1
-117.5	42.5	156;2
-112.5	42.5	156;1
-107.5	42.5	155;2
-102.5	42.5	155;1
-97.5	42.5	154;2
-92.5	42.5	154;1
-87.5	42.5	153;2
-82.5	42.5	153;1
-77.5	42.5	152;2
-72.5	42.5	152;1
-67.5	42.5	151;2
-62.5	42.5	151;1
-57.5	42.5	150;2
-52.5	42.5	150;1
-47.5	42.5	149;2
-42.5	42.5	149;1
-37.5	42.5	148;2
-32.5	42.5	148;1
-27.5	42.5	147;2
-22.5	42.5	147;1
-17.5	42.5	146;2
-12.5	42.5	146;1
-7.5	42.5	145;2
-2.5	42.5	145;1
2.5	42.5	180;1
7.5	42.5	180;2
12.5	42.5	179;1
17.5	42.5	179;2
22.5	42.5	178;1
27.5	42.5	178;2
32.5	42.5	177;1
37.5	42.5	177;2
42.5	42.5	176;1
47.5	42.5	176;2
52.5	42.5	175;1
57.5	42.5	175;2
62.5	42.5	174;1

Longitude	Latitude	Marsden
67.5	42.5	174;2
72.5	42.5	173;1
77.5	42.5	173;2
82.5	42.5	172;1
87.5	42.5	172;2
92.5	42.5	171;1
97.5	42.5	171;2
102.5	42.5	170;1
107.5	42.5	170;2
112.5	42.5	169;1
117.5	42.5	169;2
122.5	42.5	168;1
127.5	42.5	168;2
132.5	42.5	167;1
137.5	42.5	167;2
142.5	42.5	166;1
147.5	42.5	166;2
152.5	42.5	165;1
157.5	42.5	165;2
162.5	42.5	164;1
167.5	42.5	164;2
172.5	42.5	163;1
-177.5	47.5	162;4
-172.5	47.5	162;3
-167.5	47.5	161;4
-162.5	47.5	161;3
-157.5	47.5	160;4
-152.5	47.5	160;3
-147.5	47.5	159;4
-142.5	47.5	159;3
-137.5	47.5	158;4
-132.5	47.5	158;3
-127.5	47.5	157;4
-122.5	47.5	157;3
-117.5	47.5	156;4
-112.5	47.5	156;3
-107.5	47.5	155;4
-102.5	47.5	155;3

Longitude	Latitude	Marsden
-97.5	47.5	154;4
-92.5	47.5	154;3
-87.5	47.5	153;4
-82.5	47.5	153;3
-77.5	47.5	152;4
-72.5	47.5	152;3
-67.5	47.5	151;4
-62.5	47.5	151;3
-57.5	47.5	150;4
-52.5	47.5	150;3
-47.5	47.5	149;4
-42.5	47.5	149;3
-37.5	47.5	148;4
-32.5	47.5	148;3
-27.5	47.5	147;4
-22.5	47.5	147;3
-17.5	47.5	146;4
-12.5	47.5	146;3
-7.5	47.5	145;4
-2.5	47.5	145;3
2.5	47.5	180;3
7.5	47.5	180;4
12.5	47.5	179;3
17.5	47.5	179;4
22.5	47.5	178;3
27.5	47.5	178;4
32.5	47.5	177;3
37.5	47.5	177;4
42.5	47.5	176;3
47.5	47.5	176;4
52.5	47.5	175;3
57.5	47.5	175;4
62.5	47.5	174;3
67.5	47.5	174;4
72.5	47.5	173;3
77.5	47.5	173;4
82.5	47.5	172;3
87.5	47.5	172;4

Longitude	Latitude	Marsden
92.5	47.5	171;3
97.5	47.5	171;4
102.5	47.5	170;3
107.5	47.5	170;4
112.5	47.5	169;3
117.5	47.5	169;4
122.5	47.5	168;3
127.5	47.5	168;4
132.5	47.5	167;3
137.5	47.5	167;4
142.5	47.5	166;3
147.5	47.5	166;4
152.5	47.5	165;3
157.5	47.5	165;4
162.5	47.5	164;3
167.5	47.5	164;4
172.5	47.5	163;3
-177.5	52.5	198;2
-172.5	52.5	198;1
-167.5	52.5	197;2
-162.5	52.5	197;1
-157.5	52.5	196;2
-152.5	52.5	196;1
-147.5	52.5	195;2
-142.5	52.5	195;1
-137.5	52.5	194;2
-132.5	52.5	194;1
-127.5	52.5	193;2
-122.5	52.5	193;1
-117.5	52.5	192;2
-112.5	52.5	192;1
-107.5	52.5	191;2
-102.5	52.5	191;1
-97.5	52.5	190;2
-92.5	52.5	190;1
-87.5	52.5	189;2
-82.5	52.5	189;1
-77.5	52.5	188;2

Longitude	Latitude	Marsden
-72.5	52.5	188;1
-67.5	52.5	187;2
-62.5	52.5	187;1
-57.5	52.5	186;2
-52.5	52.5	186;1
-47.5	52.5	185;2
-42.5	52.5	185;1
-37.5	52.5	184;2
-32.5	52.5	184;1
-27.5	52.5	183;2
-22.5	52.5	183;1
-17.5	52.5	182;2
-12.5	52.5	182;1
-7.5	52.5	181;2
-2.5	52.5	181;1
2.5	52.5	216;1
7.5	52.5	216;2
12.5	52.5	215;1
17.5	52.5	215;2
22.5	52.5	214;1
27.5	52.5	214;2
32.5	52.5	213;1
37.5	52.5	213;2
42.5	52.5	212;1
47.5	52.5	212;2
52.5	52.5	211;1
57.5	52.5	211;2
62.5	52.5	210;1
67.5	52.5	210;2
72.5	52.5	209;1
77.5	52.5	209;2
82.5	52.5	208;1
87.5	52.5	208;2
92.5	52.5	207;1
97.5	52.5	207;2
102.5	52.5	206;1
107.5	52.5	206;2
112.5	52.5	205;1

Longitude	Latitude	Marsden
117.5	52.5	205;2
122.5	52.5	204;1
127.5	52.5	204;2
132.5	52.5	203;1
137.5	52.5	203;2
142.5	52.5	202;1
147.5	52.5	202;2
152.5	52.5	201;1
157.5	52.5	201;2
162.5	52.5	200;1
167.5	52.5	200;2
172.5	52.5	199;1
-177.5	57.5	198;4
-172.5	57.5	198;3
-167.5	57.5	197;4
-162.5	57.5	197;3
-157.5	57.5	196;4
-152.5	57.5	196;3
-147.5	57.5	195;4
-142.5	57.5	195;3
-137.5	57.5	194;4
-132.5	57.5	194;3
-127.5	57.5	193;4
-122.5	57.5	193;3
-117.5	57.5	192;4
-112.5	57.5	192;3
-107.5	57.5	191;4
-102.5	57.5	191;3
-97.5	57.5	190;4
-92.5	57.5	190;3
-87.5	57.5	189;4
-82.5	57.5	189;3
-77.5	57.5	188;4
-72.5	57.5	188;3
-67.5	57.5	187;4
-62.5	57.5	187;3
-57.5	57.5	186;4
-52.5	57.5	186;3

Longitude	Latitude	Marsden
-47.5	57.5	185;4
-42.5	57.5	185;3
-37.5	57.5	184;4
-32.5	57.5	184;3
-27.5	57.5	183;4
-22.5	57.5	183;3
-17.5	57.5	182;4
-12.5	57.5	182;3
-7.5	57.5	181;4
-2.5	57.5	181;3
2.5	57.5	216;3
7.5	57.5	216;4
12.5	57.5	215;3
17.5	57.5	215;4
22.5	57.5	214;3
27.5	57.5	214;4
32.5	57.5	213;3
37.5	57.5	213;4
42.5	57.5	212;3
47.5	57.5	212;4
52.5	57.5	211;3
57.5	57.5	211;4
62.5	57.5	210;3
67.5	57.5	210;4
72.5	57.5	209;3
77.5	57.5	209;4
82.5	57.5	208;3
87.5	57.5	208;4
92.5	57.5	207;3
97.5	57.5	207;4
102.5	57.5	206;3
107.5	57.5	206;4
112.5	57.5	205;3
117.5	57.5	205;4
122.5	57.5	204;3
127.5	57.5	204;4
132.5	57.5	203;3
137.5	57.5	203;4

Longitude	Latitude	Marsden
142.5	57.5	202;3
147.5	57.5	202;4
152.5	57.5	201;3
157.5	57.5	201;4
162.5	57.5	200;3
167.5	57.5	200;4
172.5	57.5	199;3
-177.5	62.5	234;2
-172.5	62.5	234;1
-167.5	62.5	233;2
-162.5	62.5	233;1
-157.5	62.5	232;2
-152.5	62.5	232;1
-147.5	62.5	231;2
-142.5	62.5	231;1
-137.5	62.5	230;2
-132.5	62.5	230;1
-127.5	62.5	229;2
-122.5	62.5	229;1
-117.5	62.5	228;2
-112.5	62.5	228;1
-107.5	62.5	227;2
-102.5	62.5	227;1
-97.5	62.5	226;2
-92.5	62.5	226;1
-87.5	62.5	225;2
-82.5	62.5	225;1
-77.5	62.5	224;2
-72.5	62.5	224;1
-67.5	62.5	223;2
-62.5	62.5	223;1
-57.5	62.5	222;2
-52.5	62.5	222;1
-47.5	62.5	221;2
-42.5	62.5	221;1
-37.5	62.5	220;2
-32.5	62.5	220;1
-27.5	62.5	219;2

Longitude	Latitude	Marsden
-22.5	62.5	219;1
-17.5	62.5	218;2
-12.5	62.5	218;1
-7.5	62.5	217;2
-2.5	62.5	217;1
2.5	62.5	252;1
7.5	62.5	252;2
12.5	62.5	251;1
17.5	62.5	251;2
22.5	62.5	250;1
27.5	62.5	250;2
32.5	62.5	249;1
37.5	62.5	249;2
42.5	62.5	248;1
47.5	62.5	248;2
52.5	62.5	247;1
57.5	62.5	247;2
62.5	62.5	246;1
67.5	62.5	246;2
72.5	62.5	245;1
77.5	62.5	245;2
82.5	62.5	244;1
87.5	62.5	244;2
92.5	62.5	243;1
97.5	62.5	243;2
102.5	62.5	242;1
107.5	62.5	242;2
112.5	62.5	241;1
117.5	62.5	241;2
122.5	62.5	240;1
127.5	62.5	240;2
132.5	62.5	239;1
137.5	62.5	239;2
142.5	62.5	238;1
147.5	62.5	238;2
152.5	62.5	237;1
157.5	62.5	237;2
162.5	62.5	236;1

Longitude	Latitude	Marsden
167.5	62.5	236;2
172.5	62.5	235;1
-177.5	67.5	234;4
-172.5	67.5	234;3
-167.5	67.5	233;4
-162.5	67.5	233;3
-157.5	67.5	232;4
-152.5	67.5	232;3
-147.5	67.5	231;4
-142.5	67.5	231;3
-137.5	67.5	230;4
-132.5	67.5	230;3
-127.5	67.5	229;4
-122.5	67.5	229;3
-117.5	67.5	228;4
-112.5	67.5	228;3
-107.5	67.5	227;4
-102.5	67.5	227;3
-97.5	67.5	226;4
-92.5	67.5	226;3
-87.5	67.5	225;4
-82.5	67.5	225;3
-77.5	67.5	224;4
-72.5	67.5	224;3
-67.5	67.5	223;4
-62.5	67.5	223;3
-57.5	67.5	222;4
-52.5	67.5	222;3
-47.5	67.5	221;4
-42.5	67.5	221;3
-37.5	67.5	220;4
-32.5	67.5	220;3
-27.5	67.5	219;4
-22.5	67.5	219;3
-17.5	67.5	218;4
-12.5	67.5	218;3
-7.5	67.5	217;4
-2.5	67.5	217;3

Longitude	Latitude	Marsden
2.5	67.5	252;3
7.5	67.5	252;4
12.5	67.5	251;3
17.5	67.5	251;4
22.5	67.5	250;3
27.5	67.5	250;4
32.5	67.5	249;3
37.5	67.5	249;4
42.5	67.5	248;3
47.5	67.5	248;4
52.5	67.5	247;3
57.5	67.5	247;4
62.5	67.5	246;3
67.5	67.5	246;4
72.5	67.5	245;3
77.5	67.5	245;4
82.5	67.5	244;3
87.5	67.5	244;4
92.5	67.5	243;3
97.5	67.5	243;4
102.5	67.5	242;3
107.5	67.5	242;4
112.5	67.5	241;3
117.5	67.5	241;4
122.5	67.5	240;3
127.5	67.5	240;4
132.5	67.5	239;3
137.5	67.5	239;4
142.5	67.5	238;3
147.5	67.5	238;4
152.5	67.5	237;3
157.5	67.5	237;4
162.5	67.5	236;3
167.5	67.5	236;4
172.5	67.5	235;3
-177.5	72.5	270;2
-172.5	72.5	270;1
-167.5	72.5	269;2

Longitude	Latitude	Marsden
-162.5	72.5	269;1
-157.5	72.5	268;2
-152.5	72.5	268;1
-147.5	72.5	267;2
-142.5	72.5	267;1
-137.5	72.5	266;2
-132.5	72.5	266;1
-127.5	72.5	265;2
-122.5	72.5	265;1
-117.5	72.5	264;2
-112.5	72.5	264;1
-107.5	72.5	263;2
-102.5	72.5	263;1
-97.5	72.5	262;2
-92.5	72.5	262;1
-87.5	72.5	261;2
-82.5	72.5	261;1
-77.5	72.5	260;2
-72.5	72.5	260;1
-67.5	72.5	259;2
-62.5	72.5	259;1
-57.5	72.5	258;2
-52.5	72.5	258;1
-47.5	72.5	257;2
-42.5	72.5	257;1
-37.5	72.5	256;2
-32.5	72.5	256;1
-27.5	72.5	255;2
-22.5	72.5	255;1
-17.5	72.5	254;2
-12.5	72.5	254;1
-7.5	72.5	253;2
-2.5	72.5	253;1
2.5	72.5	288;1
7.5	72.5	288;2
12.5	72.5	287;1
17.5	72.5	287;2
22.5	72.5	286;1

Longitude	Latitude	Marsden
27.5	72.5	286;2
32.5	72.5	285;1
37.5	72.5	285;2
42.5	72.5	284;1
47.5	72.5	284;2
52.5	72.5	283;1
57.5	72.5	283;2
62.5	72.5	282;1
67.5	72.5	282;2
72.5	72.5	281;1
77.5	72.5	281;2
82.5	72.5	280;1
87.5	72.5	280;2
92.5	72.5	279;1
97.5	72.5	279;2
102.5	72.5	278;1
107.5	72.5	278;2
112.5	72.5	277;1
117.5	72.5	277;2
122.5	72.5	276;1
127.5	72.5	276;2
132.5	72.5	275;1
137.5	72.5	275;2
142.5	72.5	274;1
147.5	72.5	274;2
152.5	72.5	273;1
157.5	72.5	273;2
162.5	72.5	272;1
167.5	72.5	272;2
172.5	72.5	271;1
-177.5	77.5	270;4
-172.5	77.5	270;3
-167.5	77.5	269;4
-162.5	77.5	269;3
-157.5	77.5	268;4
-152.5	77.5	268;3
-147.5	77.5	267;4
-142.5	77.5	267;3

Longitude	Latitude	Marsden
-137.5	77.5	266;4
-132.5	77.5	266;3
-127.5	77.5	265;4
-122.5	77.5	265;3
-117.5	77.5	264;4
-112.5	77.5	264;3
-107.5	77.5	263;4
-102.5	77.5	263;3
-97.5	77.5	262;4
-92.5	77.5	262;3
-87.5	77.5	261;4
-82.5	77.5	261;3
-77.5	77.5	260;4
-72.5	77.5	260;3
-67.5	77.5	259;4
-62.5	77.5	259;3
-57.5	77.5	258;4
-52.5	77.5	258;3
-47.5	77.5	257;4
-42.5	77.5	257;3
-37.5	77.5	256;4
-32.5	77.5	256;3
-27.5	77.5	255;4
-22.5	77.5	255;3
-17.5	77.5	254;4
-12.5	77.5	254;3
-7.5	77.5	253;4
-2.5	77.5	253;3
2.5	77.5	288;3
7.5	77.5	288;4
12.5	77.5	287;3
17.5	77.5	287;4
22.5	77.5	286;3
27.5	77.5	286;4
32.5	77.5	285;3
37.5	77.5	285;4
42.5	77.5	284;3
47.5	77.5	284;4

Longitude	Latitude	Marsden
52.5	77.5	283;3
57.5	77.5	283;4
62.5	77.5	282;3
67.5	77.5	282;4
72.5	77.5	281;3
77.5	77.5	281;4
82.5	77.5	280;3
87.5	77.5	280;4
92.5	77.5	279;3
97.5	77.5	279;4
102.5	77.5	278;3
107.5	77.5	278;4
112.5	77.5	277;3
117.5	77.5	277;4
122.5	77.5	276;3
127.5	77.5	276;4
132.5	77.5	275;3
137.5	77.5	275;4
142.5	77.5	274;3
147.5	77.5	274;4
152.5	77.5	273;3
157.5	77.5	273;4
162.5	77.5	272;3
167.5	77.5	272;4
172.5	77.5	271;3
-177.5	82.5	918;2
-172.5	82.5	918;1
-167.5	82.5	917;2
-162.5	82.5	917;1
-157.5	82.5	916;2
-152.5	82.5	916;1
-147.5	82.5	915;2
-142.5	82.5	915;1
-137.5	82.5	914;2
-132.5	82.5	914;1
-127.5	82.5	913;2
-122.5	82.5	913;1
-117.5	82.5	912;2

Longitude	Latitude	Marsden
-112.5	82.5	912;1
-107.5	82.5	911;2
-102.5	82.5	911;1
-97.5	82.5	910;2
-92.5	82.5	910;1
-87.5	82.5	909;2
-82.5	82.5	909;1
-77.5	82.5	908;2
-72.5	82.5	908;1
-67.5	82.5	907;2
-62.5	82.5	907;1
-57.5	82.5	906;2
-52.5	82.5	906;1
-47.5	82.5	905;2
-42.5	82.5	905;1
-37.5	82.5	904;2
-32.5	82.5	904;1
-27.5	82.5	903;2
-22.5	82.5	903;1
-17.5	82.5	902;2
-12.5	82.5	902;1
-7.5	82.5	901;2
-2.5	82.5	901;1
2.5	82.5	936;1
7.5	82.5	936;2
12.5	82.5	935;1
17.5	82.5	935;2
22.5	82.5	934;1
27.5	82.5	934;2
32.5	82.5	933;1
37.5	82.5	933;2
42.5	82.5	932;1
47.5	82.5	932;2
52.5	82.5	931;1
57.5	82.5	931;2
62.5	82.5	930;1
67.5	82.5	930;2
72.5	82.5	929;1

Longitude	Latitude	Marsden
77.5	82.5	929;2
82.5	82.5	928;1
87.5	82.5	928;2
92.5	82.5	927;1
97.5	82.5	927;2
102.5	82.5	926;1
107.5	82.5	926;2
112.5	82.5	925;1
117.5	82.5	925;2
122.5	82.5	924;1
127.5	82.5	924;2
132.5	82.5	923;1
137.5	82.5	923;2
142.5	82.5	922;1
147.5	82.5	922;2
152.5	82.5	921;1
157.5	82.5	921;2
162.5	82.5	920;1
167.5	82.5	920;2
172.5	82.5	919;1

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